



ARCHIVES OF

*Physical Medicine  
and  
Rehabilitation*

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Volume 42, No. 7

# Archives of Physical Medicine and Rehabilitation

## Code of Advertising

The *Archives of Physical Medicine and Rehabilitation*, published monthly by the American Congress of Physical Medicine and Rehabilitation, is interested in the maintenance of the highest standards in advertising in the interest of its readers in the medical and closely allied professions, the various manufacturers and patients. The *Archives of Physical Medicine and Rehabilitation* believes that honest, straightforward and informative promotion is essential in the merchandising of products and apparatus affecting the health and welfare of the general public. For this reason, the APM&R has formulated some basic principles to serve as a guide to manufacturers and advertisers.

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AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION

AMERICAN ACADEMY OF PHYSICAL MEDICINE AND REHABILITATION

★ 30 N. Michigan Avenue, Chicago 2, Illinois

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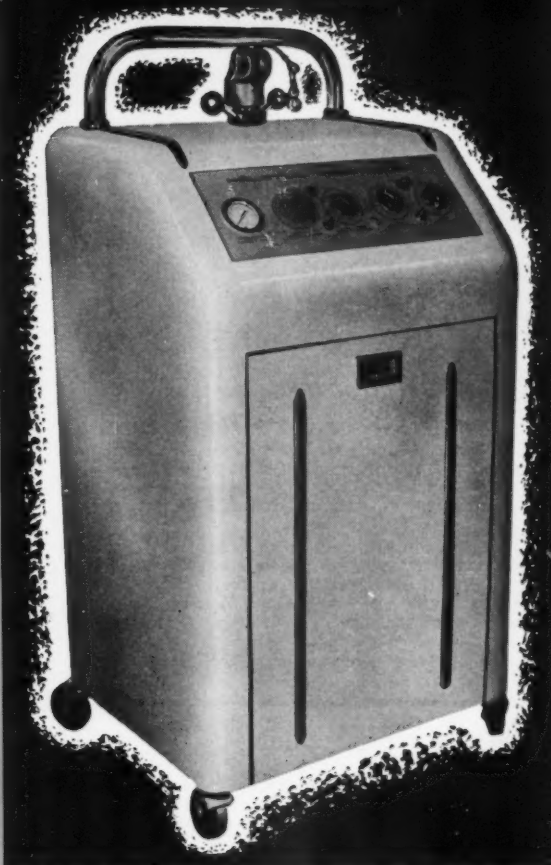
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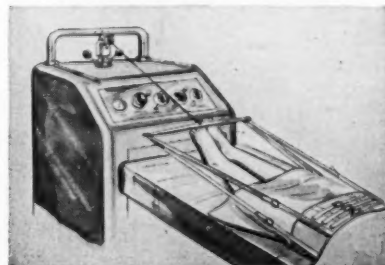
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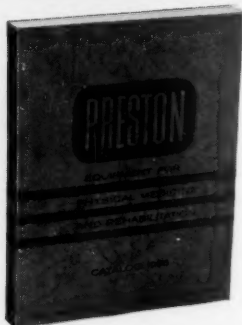
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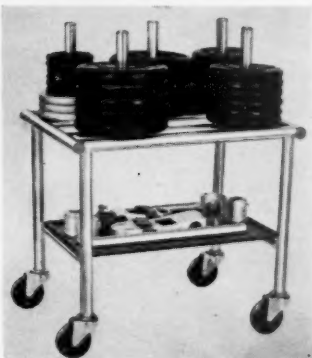
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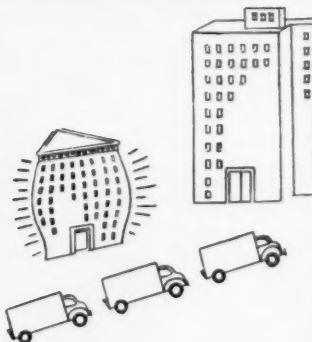
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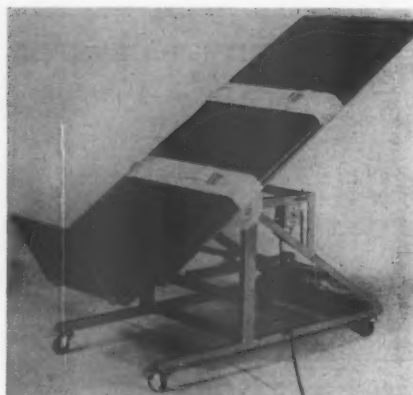
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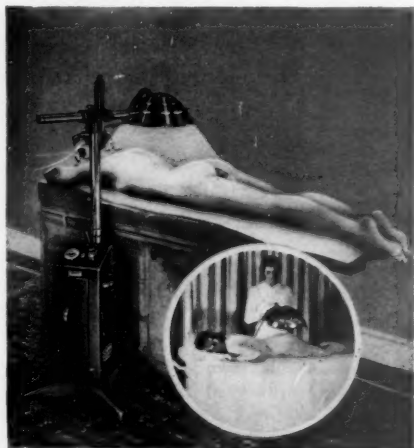


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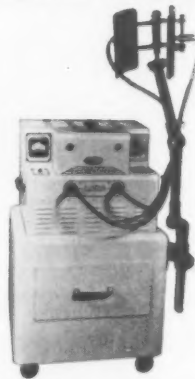
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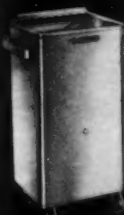
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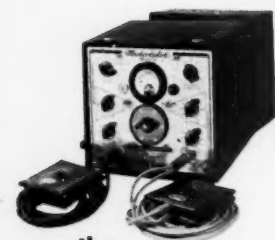
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# Compensation for Contracture Deformity in an improved Socket Design for Above-Knee Prostheses

Miles H. Anderson, Ed.D.  
John J. Bray, C.P., C.O.  
and  
Charles O. Bechtol, M.D.  
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● Between March, 1956, and June, 1958, a total of 301 quadrilateral suction socket prostheses were fitted as part of the teaching activities of the Prosthetics Education Program of the University of California Medical School at Los Angeles. Accurate records were kept of stump perimeters, socket inside perimeters, flexion and abduction contracture angles, and stump condition. These records were analyzed in June, 1958, and three problems appeared to be serious enough in approximately 50 per cent of the cases to warrant further study. These problems were edema in the distal portion of the stump, wide-base gait, and excessive anterior pelvic rotation. Differing methods and instruments were developed for making accurate measurements of the amount of flexion contracture that would have to be compensated for in prosthesis socket design if anterior pelvic rotation were to be held to 10 degrees or less; for making accurate measurements of abduction contracture, and methods developed for designing the socket to compensate for such contracture, to hold the gait base to not more than two inches. Methods were developed for shaping the socket with shoulders inside to give support to the end portion of the stump. Sixty prostheses have been fitted using these techniques between September, 1959, and June, 1960. Follow-up observation and examination indicates that edema has been markedly reduced and in most cases eliminated, and stump condition improved. Anterior pelvic rotation is held to a maximum of 10 degrees and gait base to a maximum of two inches.

This is a report on a research project on above-knee prosthetics conducted by the staff of the Prosthetics Education Program in the Medical School at the University of California, Los Angeles. The need for this research was brought out by the experience of training 175 prosthetists in above-knee prosthetics, from March, 1956, through June, 1959, when 301 above-knee quadrilateral suction socket prostheses were fitted. Accurate records were kept of the amputees' stump perimeters, amounts of flexion and abduction contracture, stump condition, and socket inside perimeters. The amputees were re-examined and measured at intervals of approximately two months and the measurements and stump conditions recorded. In June, 1958, these records and the amputees themselves were critically analyzed and several problems became evident in approximately 50 per cent of the total number of amputees studied. These problems were: edema in the distal portion of the stump, wide-base gait

caused by uncompensated abduction contractures, and excessive anterior pelvic rotation caused by uncompensated flexion contractures.

A request for funds to pay for the costs of carrying on further studies with these amputees was submitted to the Veterans Administration Prosthetic and Sensory Aids Service. A contract to do this research was approved Dec. 23, 1958, and the work started.

Investigation of the causes and possible remedies for the difficulties noted above was started with a reconsideration of the methods of measuring the degree of flexion and abduction contracture in the amputees' stumps and the method of incorporating these data into the planning of the prosthesis socket. A review of the studies of human locomotion<sup>1</sup> made at the University of California at Berkeley indicates that at push-off a line from the center of the hip joint to the center of the ankle joint is about 15 degrees posterior to the vertical. However, this 15 degrees is not entirely achieved through hip extension. About three degrees of the 15 is the result of anterior pelvic rotation, hip extension accounts for five degrees, and the remaining seven degrees is caused by knee flexion. The latter fact is the key to the problem. An amputee cannot duplicate this as he cannot push-off with a prosthesis that has the knee flexed seven degrees. Careful observation of slow motion pictures of 25 amputees walking

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Read at the 3rd International Congress of Physical Medicine, Session on Orthotics and Prosthetics, Washington, D. C., August 26, 1960.



showed that they managed in most cases to get the ankle-hip line 15 degrees posterior to the vertical by keeping the knee extended and increasing the anterior pelvic rotation to approximately 10 degrees. These amputees had no flexion or abduction contractures as in each case they could extend the amputated femur five degrees posterior to the vertical and could touch the sound leg with the stump. It was believed by the consulting orthopedists on the staff that these amputees could tolerate up to 10 degrees of anterior pelvic rotation without more than normal wear and tear on the spine. However, they felt that this would be true only when the patients were free of any pathologic condition in the spine that might be aggravated by this amount of motion. It was accepted as a criterion then, that no more than 10 degrees of anterior pelvic rotation would be acceptable.

This rule is fine as long as you have amputees who have no flexion contractures, but such contractures are fairly common, and are a difficult problem when encountered. The next step in the study was to devise an accurate method of measuring the amount of flexion contracture that would have to be compensated for in the prosthesis, to stay within the confines of the 10 degree rule. The usual method of measuring hip flexion contracture in the "Thomas position" was not satisfactory as a prosthetic measure because it does not account for the amount of anterior pelvic rotation. A means was devised for making the measurement of hip flexion at the exact instant the pelvis started anterior rotation from rest position. This made it possible to determine the exact amount of flexion angle to design in the socket. If an amputee with a 30 degree flexion contracture has it reduced to 10 degrees through treatment by the physiatrist, it is necessary to design a socket that will have enough initial flexion built in to enable the amputee to walk properly.

Measuring abduction contracture did not present as complex a problem as in the case of flexion contracture. However, devising a system for designing a socket to compensate for it accurately was

another matter. The original socket layout technic required that the medial wall be vertical. It was found that when amputees had an abduction contracture, fitting them with the vertical medial wall resulted in a wide-base gait. When the degree of contracture is measured accurately and this factor introduced into the socket layout procedure, the medial wall tends to be slanted laterally in proportion to the amount of contracture present.

The problem of edema was the most difficult. Careful study of the amputee data revealed that edema was present in the smallest amounts when the perimeter measurements of the socket were such that the surface of the stump was under some degree of pressure over its full length. A means for analyzing the tension exerted on the stump by the socket was developed. At first the perimeters of the stump and those of the socket were plotted on a graph and compared (fig. 1). This was difficult to interpret, so a better method was devised by which the *differences* between the socket and stump perimeters at each level were plotted. The resulting tension analysis chart (fig. 2) shows at a glance the amount the socket is larger or smaller than the stump. These tension analysis charts were made for 110 fittings, and the amputees were observed at regular intervals of approximately every two months. It was noted that invariably when the socket perimeters in the lower portion of the socket were greater than those of the stump, edema resulted. The tension furnished by having the socket perimeters in the distal portion smaller by only one-eighth inch than the stump perimeters has been found to be sufficient to maintain good stump condition, and on the other hand, having the distal portion of the socket larger than the stump by that amount has been observed to cause edema. It must be remembered that one-eighth inch in a typical socket inside perimeter of 19 inches is rather difficult to measure and control. The socket tension in the proximal third of the socket must always be greater than in the distal two-thirds.

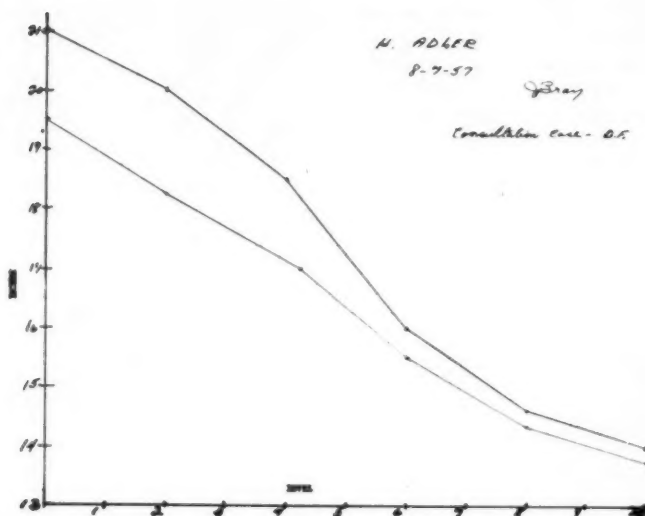


Fig. 1 — Stump perimeters and socket perimeters compared on graph.

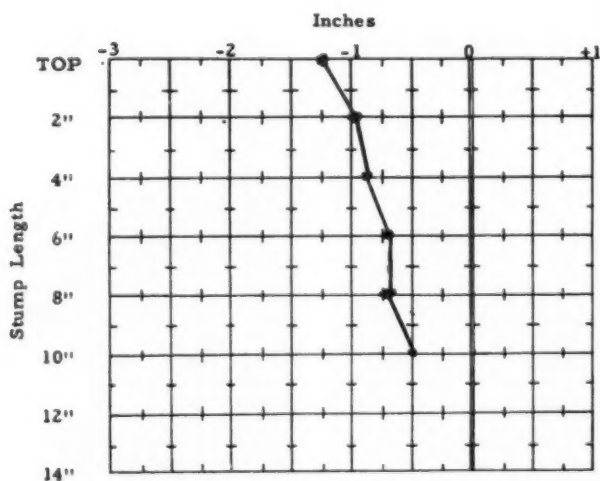


Fig. 2 — Differences between stump perimeters and socket perimeters plotted as single line on graph (tension analysis chart).

A second factor was experimented with to contribute to edema control, the provision of shoulders in the distal portion of the socket to provide support for the end of the stump (fig. 3). It was found that the counter-pressure provided by these shoulders made a significant difference in the degree of edema in 10 patients who were fitted with successive sockets with identical perimeters but with the first sockets having a conventional straight bore below the stump (fig. 4), the second having shoulders. To prevent the end of the stump from

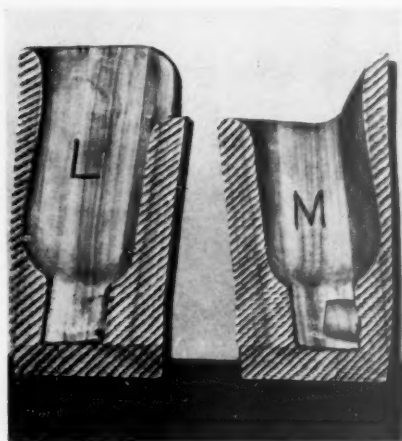


Fig. 3 — Shoulders in distal portion of socket.

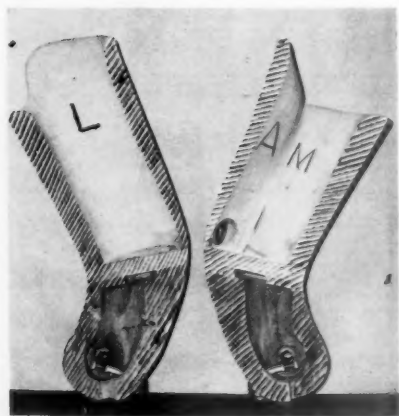


Fig. 4 — Socket showing typical straight bore below stump.

protruding down into the hole in the end of the socket, pads of sponge rubber were provided, so that to some extent, a total contact socket was achieved.

The use of sponge rubber padding caused problems, as it was difficult for the amputees to pull themselves into the socket; the stockinette would not slip past the sponge material very easily.

Several laboratories have been working on a total contact above-knee prosthesis socket. The attempt is not to bear weight on the end of the stump, but to have the flesh of the end of the stump firmly in contact with the socket. Fair success has been obtained by using a special quadrilateral collar as the basis for a wrap cast of the stump, the latter then being used to make a mold, which in turn is modified and used as the base for a plastic socket.<sup>2</sup> Another approach used with some success is to make a conventional wood quadrilateral socket, then inject plaster into the lower portion while the amputee bears weight on it with his stump. After the plaster sets up, the socket is sawed off and the plaster cast is used as the basis for making a plastic cup-shaped piece that reflects the shape of the end of the stump. This piece is then equipped with a valve and is sealed into place in the socket, the two parts of which are then glued back together. Ned Snygg of San Francisco has verbally reported having good success with this method.

The distal shoulders in the socket, as developed at the University of California, Los Angeles, came so close to being a total contact socket that further experimentation was tried in an effort to make it so without the need for any plastic laminating procedures, if possible. The problems were to find a material to fill up the hole in the end of the socket that could be shaped with available tools after it set up, and some means for installing the total contact suction socket valve.

A number of different materials were tried for use in filling the end of the socket. The most successful was a mixture of Bakelite Microballoons and polyester resin. The Microballoons are tiny, hollow globules of resin, which,

when mixed with resin, make a putty that is very light in weight.

The material was used by the researchers at the University of California at Berkeley to cement the socket of their below-knee prosthesis into the wooden shank block. It has proved very successful as a material to fill the end of the above-knee sockets. After it has cured it can be shaped and smoothed to the

contour of the stump.

The problem of installing the valve required the designing of a special combination drill and counterboring tool (fig. 5). This valve must be inserted into the wall of the socket from the inside, and it has a wide flange that must be faired into the curvature of the inner wall without any rim projection that might irritate the stump (fig. 6). A tapered recess must be cut into the wood into which the flange of the valve must seat. Doing this accurately in the narrow confines of the bottom of a socket is not easy. The special tool was designed to do this. It consists of a double cutting head, one head being  $1\frac{1}{4}$  inches in diameter, the other  $1\frac{3}{4}$  inches in diameter. The smaller head cuts the hole for the body of the valve, the larger one countersinks the taper for the flange. Since it is impossible to drive the tool at the proper angle in the narrow confines of the socket, the one-half inch drive shaft is removable from the head. A one-half inch pilot hole is drilled at the proper angle into the socket from the outside, the special cutting head is inserted into the socket, the drive shaft is inserted into the hole and into the cutting head. The set screws on the head are tightened, then the shaft is fastened into the chuck of the drill press. As the tool is revolved in the drill press, the socket is pulled down until the valve hole and flange seat are formed properly, after which the valve can be cemented in place (fig. 7).

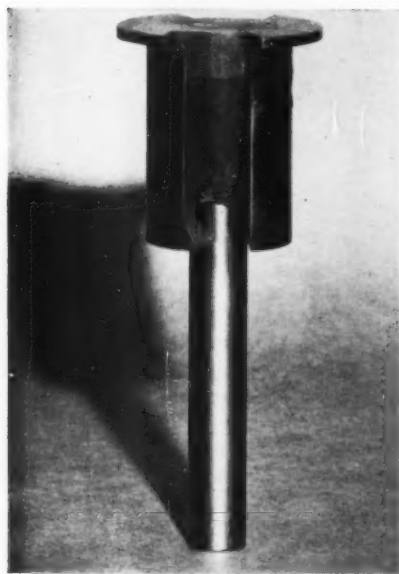


Fig. 5 — Combination drill and counterboring tool.

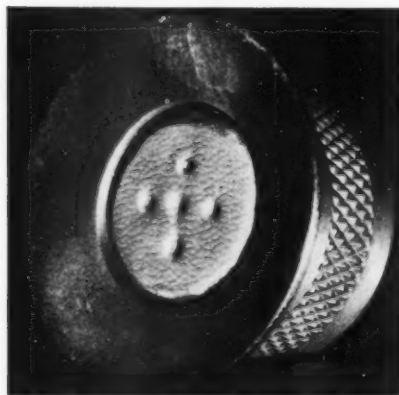


Fig. 6 — Special valve (with wide flange) for total contact socket.

The advantage of this technic for making a total contact above-knee socket lies in the fact that the prosthetists do not have to be re-trained in an entirely new technic of above-knee prosthesis socket fitting. By following the procedures and principles outlined in the instruction manual,<sup>3</sup> then adding the extra steps outlined here, they can obtain satisfactory results. Sixty above-knee prostheses have been fitted since September, 1959, using all the technics described in this report. Follow-up examinations reveal that edema is no longer a problem with the patients so fitted. Gait analysis records indicate definite improvements in walking.



Fig. 7—Total contact socket finished in the distal end with "microballoon" plastic putty, and with the special valve cemented in place.

### Summary

1. Between March, 1956, and June, 1958, a total of 301 quadrilateral suction socket prostheses were fitted as part of the teaching activities of the Prosthetics Education Program of the University of California, Los Angeles, Medical School. Accurate records were kept of stump perimeters, socket inside perimeters, flexion and abduction contracture angles, and stump condition.

2. These records were analyzed in June, 1958, and three problems appeared to be serious enough in approximately 50 per cent of the cases to warrant further study. These problems were:

- a. Edema in the distal portion of the stump.
- b. Wide-base gait.
- c. Excessive anterior pelvic rotation.

3. A research contract was negotiated with the Veterans Administration, and further investigation of these problems was undertaken.

4. Methods and instruments were developed for making accurate measurements of the amount of flexion contracture that would have to be compensated for in prosthesis socket

design if anterior pelvic rotation was to be held to 10 degrees or less. Methods for designing the socket to make this compensation were developed.

5. Methods and instruments were developed for making accurate measurements of abduction contracture, and methods were developed for designing the socket to compensate for such contracture to hold the gait base to not more than two inches.

6. Methods were developed for shaping the socket with shoulders inside to give support to the end portion of the stump. A means for forming a total contact socket using Microballoons and polyester resin as a filler was developed. In addition, a special tool for installing the valve in the total contact socket was designed and built.

7. Sixty prostheses have been fitted using these technics between September, 1959, and June, 1960. Follow-up observation and examination indicate that edema has been markedly reduced and in most cases eliminated, and stump condition improved. Anterior pelvic rotation is held to a maximum of 10 degrees, and gait base to a maximum of two inches.



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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.



Chance is a word void of sense; nothing can exist without a cause.

— VOLTAIRE

# Acute Soft Tissue Calcinosis

Samuel G. Feuer, M.D.  
and  
Otto Fliegel, M.D.  
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● Acute deposit of calcium salt in soft tissues is a morbid entity often mistaken for acute cellulitis, gout or the like. It has been observed in various areas of the upper and lower extremities. The natural history of the disease as well as its clinical and x-ray appearances are discussed. A series of nine cases with x-ray illustrations is presented. The condition, termed acute soft tissue calcinosis, is classified as belonging within the group of extra-skeletal calcinosis, the chronic forms of which have been described as calcinosis interstitialis, circumscripta, tumorous, respectively. Calcareous gout or "Kalkgicht," a term originated many years ago by German authors who believed that a particular "diathesis" comparable to genuine gout made the patient liable to these conditions, has been abandoned because of lack of evidence of distinct laboratory features, though it is an alluring concept. It will be demonstrated that this condition is a self-limited one. On the basis of this experience, the treatment is discussed. Essentially, the differential diagnosis of this condition and that of calcified tendinitis and bursitis is extremely important to the physiatrist because of the wide variation in type of treatment. The latter calls for a dynamic program of physical therapy and exercise, whereas the former will be shown to respond adequately to physiologic rest.

While physicians by and large are familiar with the pathology and the clinical appearance of the peritendinitis calcarea of the shoulder, it is less well known that calcific deposits in other regions of the body may occur with an acute and extremely painful symptom-complex.

During the past few years the authors have had the opportunity to observe several cases of acute soft tissue swelling in the vicinity of joints in the upper and lower extremity which invariably are combined with calcareous deposits. Whenever and wherever these swellings and deposits occurred, the same symptomatology was present: they present a disease entity which can be properly termed "acute soft tissue calcinosis." It is our desire to present our observations and experience and to describe the essential features and the management of this acutely painful condition, the study of which was initiated several years ago by one of us (O.F.).

There have been several reports in the literature<sup>1-5</sup> unquestionably dealing with the same clinical condition, but published under various other terminologies. An extensive study was published by Sandstrom<sup>4</sup> who reported several cases at various anatomic regions, but included,

as the major group, the calcified shoulder bursitis (known as peritendinitis calcificans, Duplay's disease, Codman shoulder, peri-arthritis of the shoulder, etc.) These cases have been deliberately omitted from our present discussion for reasons discussed later in this paper. Despite the well-defined clinical picture, there are many problems still unsolved. For purpose of clarification we would like to present a brief review on the general subject of calcification.

## Calcification and Calcinosis

Although often used synonymously these two terms, calcification and calcinosis, are not quite interchangeable. Calcification is a generic term; it signifies the encrustation with calcium salt of tissue which in the course of this biologic process loses its original characteristic texture and becomes a calcific mass. Calcinosis, on the other hand, is rather a clinical term and designates the deposition of calcium salt in the pre-existing spaces between the specialized elements of the tissue involved.

## Physiologic and Pathologic Calcification

Physiologically, precipitation of calcium salt occurs into the osteoid tissue of the growing bone and in bone repair. It is an enzymatic action which disturbs the equilibrium of the soluble phase of the calcium-phosphorus ions. Change of the normal carbon dioxide tension or the calcium phosphorus relation in the extracellular fluid are essential factors in this process.<sup>6</sup> Degenerated tissue, by possibly changing the carbon dioxide tension, has a like effect. Calcification of the aging cartilage of ribs and larynx may be accounted for in this manner.

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Read at the 3rd International Congress of Physical Medicine, Session on Medical Problems Diagnosed or Treated by Physical Medicine, Washington, D. C., August 23, 1960.

Under pathologic conditions, ectopic (or extra-osseous) ossification occurs (a) in normal tissue in the presence of abnormal calcium-phosphorus metabolism and (b) in injured and degenerated tissue, with lowered cell metabolism, under normal calcium-phosphorus metabolism. The former, called metastatic calcification, is a known feature in hyperparathyroidism, vitamin D intoxication, pseudohypoparathyroidism, destructive bone diseases and other disorders. The latter condition described above, called dystrophic calcification, is found in scars, lymph glands, granulation tissues, blood vessels, cysts, etc.

The avidity of degenerated tissue to calcium is apparently the initiating factor in the chronic forms of calcosinosis, which are described as: (1) calcosinosis universalis, a rare disease, chiefly of childhood, characterized by widely spread streaked calcific deposits in muscles, tendons, fasciae which often ends fatally; (2) calcosinosis circumscripta, found in association with Raynaud's disease, scleroderma, where it not only occurs characteristically in the fingertips, but also in large conglomeration in other parts of the body; (3) a third form has been described as calcosinosis tumerosa. Only a few cases have been reported. It appears to be a condition with familial incidence, leading to calcareous tumors of large dimensions, with a tendency to break through the overlying structures and skin.

The etiology of these conditions is obscure: preceding tissue degeneration, as noted before, initiates the process of calcification.<sup>6-13</sup> German authors<sup>13, 14</sup> have described cases with tophus-like calcific deposits under the heading of "Kalkgicht" (calcareous gout). Wichmann<sup>15</sup> assumed, analogous to the uric acid diathesis, a "calcium diathesis," based on a particular metabolic error. Although this is an interesting concept, it was not adopted by the majority of Anglo-American investigators, mainly due to lack of specific laboratory findings.

#### **Acute Soft Tissue Calcosinosis (Calcosinosis Acuta Localisata)**

The concept of Kalkgicht becomes even more attractive when applied to the

acute form of calcosinosis. It cannot be denied that an acute attack of gout and the acute calcosinosis have a similar symptomatology, making a differential diagnosis often difficult and confusing, as will be noted later.

The acute calcosinosis may establish itself anywhere in the upper and, to a lesser extent, in the lower extremity, usually in the vicinity of joints (figs. 1-4). Acute calcification of intervertebral discs have also been reported in children.<sup>16-26</sup> Acute calcosinosis is a self-limited disease, with extremely acute initial symptoms, and it subsides after a brief interval with a complete return to health. The sudden onset, without prodromal symptoms, and the initial hyperacute course justifies the expression "acute calcareous attack." It usually begins during the night, acutely interrupting the sleep with severe pain. The painful area becomes reddened and swollen, and signs and symptoms increase rapidly in intensity.

#### **The Examination**

The acute state usually reveals a para-articular swelling, erythema of the skin, increased local temperature, and marked tenderness. The neighboring joint is extremely painful and is aggravated by any motion. Body temperature often is slightly elevated, but the general condition usually is undisturbed. Sedimentation rate may be slightly increased; other laboratory findings are usually insignificant.

X-ray examination reveals calcific shadow in the soft tissues about the joint. The calcific deposit is very often minute, and can easily be overlooked. At other times it may be as large as a cherry pit, or even larger. Not infrequently the calcium may be deposited in streaks or as fine granules or nodules. In the acute state, the calcium shadow is rather dense; later in the course of the condition it gradually becomes more translucent. The x-ray picture, of course, does not delineate the layer in which the calcium is deposited; however, it is known from observation of cases that have come to surgery, that these deposits usually lie within the preformed intertendinous or

intermuscular spaces or within the arcular tissue of the muscle perimysium. They are not found within a bursa or the joint capsule. It has been our experience that the relative size of the calcific focus has little bearing on the severity of the pain, minute deposits have given rise to severe pain and, conversely, large deposits have been found with little pain (figs. 1 and 2). The course of the disease is benign. Pain, swelling, and tenderness usually subside gradually within a few days and completely disappear by the 10th day. In some cases there is slight residual discomfort for another week or two. Serial x-rays show calcium deposits initially demonstrated gradually becoming more translucent and inconspicuous. Residuals are often visible in the absence of clinical symptoms, but eventually these deposits become completely absorbed.

The acute calcinosis is a disease of adult life, mainly without preference to sex. However, acute calcinosis occurring in childhood has been reported in the intervertebral discs.<sup>16-26</sup> The symptomatology of this condition which closely resembles cases of acute calcinosis in the

adult, demonstrates some relationship of these conditions.

We have not seen any cases of recurrence in the same area nor have recurrences in the same area been reported. A history of a preceding calcinosis attack in a different localization seems to be rare. So is occurrence of an attack later on in a different region of the same patient.

The etiology of the disease still is obscure. There is no proof of an abnormal calcium metabolism. Pertinent laboratory examinations are negative. The assumption of a trauma preceding tissue degeneration and calcium precipitation concurs with the well-established sequence of events, namely: nutritional impairment — decreased cell metabolism, tissue degeneration and calcium precipitation. We cannot support wholeheartedly this assumption as far as the history of our patients is concerned. In only one of our cases could we obtain a history of trauma two years before the onset of acute calcinosis. However, there possibly may be some relationship to trauma, specifically to the so-called microtraumas



Fig. 1 — Large calcium deposit shows in the third intermetacarpal space.



Fig. 2 — This is a radiograph of the same hand with the calcium deposit dissolved.

sustained during the course of normal activities of daily living and occupation. They can neither be ruled out nor proved.

Many of our cases have been observed during periods of widespread upper respiratory infections. The authors are inclined to lean to the theory that in the course of such an acute or latent infection a viral focus is established with subsequent tissue damage and secondary calcium deposition.

As far as the concept of "Kalkgicht" is concerned, we refer to the comments previously expressed.

#### Differential Diagnosis

We are mainly concerned with three conditions:

(1) Acute infectious arthritis: this shows a more stormy local condition and general disturbance. The swelling is directly over the involved joint; the joint is usually maintained in a fixed position and any attempt at active or passive motion initiates intolerable pain. Local and body temperature is elevated, as well as the sedimentation rate. Clinically the patient appears quite ill.

(2) Acute cellulitis: this condition does not show the sudden onset of the acute calcosinosis. There is a gradual increase in severity of pain, and a moderate discomfort before the acute stage is reached. One may find some evidence of skin pathology facilitating entry of pathogenic organisms. The condition is accompanied by high temperature, and lymphangitis, lymphadenitis or local fluctuation and the classic laboratory findings of an acute infectious process support the diagnosis.

(3) Acute gouty attack: this condition may strongly simulate acute calcosinosis. Familial occurrence of the disease, history of previous attacks, hyperurecemia, the response to colchicine, the rather dark cyanotic redness of the involved joint as well as the x-ray and laboratory findings aid in firmly establishing the diagnosis of this latter condition.

We have not included the numerous cases of peritendinitis calcificans of the shoulder, because we are rather skeptical as to whether all of these cases belong in the category of acute calcosinosis. Peritendinitis calcificans is a chronic



Fig. 3 — Calcific deposit at the base of the metacarpal of the thumb.



Fig. 4 — Calcific deposit at the elbow region.

disease which may or may not develop an acute exacerbation. The calcium deposit may have existed for a considerable period of time and may be a coincidental discovery during the course of a routine x-ray examination, or it may be present as a chronic focus associated with more or less tolerable pain, with little or mild restriction of motion. It is in the transition into an acute stage that this condition exhibits a symptomatology not unlike that of an acute calcinosis. However, the calcium deposit — in our experience — does not disappear after the acute attack in the majority of cases, but resumes its former chronic or dormant stage, which may become subsequently reactivated at any time. In contradistinction, patients with acute calcinosis have no chronic or dormant calcific foci. The calcific deposit in these cases is an "acute" one, and its fate is eventual complete dissolution. An acute recurrence of foci has not been reported in the literature to date. Seidenstein<sup>14</sup> stated that asymptomatic calcium deposits in this area have never been found amongst numerous cases that have been x-rayed. The same appears to be true for other localizations. As mentioned previously, there seem to be some cases that have been described as peritendinitis which present themselves in the acute form with an acute calcific deposit and without a previous history of an asymptomatic or chronic calcium focus. We believe that the pathogenesis of these cases differs from the routine peritendinitis calcificans and should be separated and diagnosed as acute calcinosis.

### Treatment

As noted in our previous discussion, spontaneous absorption of the calcific deposit can be expected within a short period of time. With the fading of the deposits, pain gradually diminishes as well as the other residual signs and symptoms. Physiologic rest of the extremely tender and acutely inflamed member is the treatment of choice. This is achieved by means of plaster casts and splints, metal splints, bandages, bed rest, etc., as indicated by the individual case. The use of analgesics and sedatives in

conjunction with this conservative treatment is definitely indicated. Local heat in the form of radiant heat or diathermy or moist heat packs may relieve or aggravate the symptoms; many patients may be relieved by cold applications, or by no applications whatsoever. Injections with Percain or Hydrocorton may be attempted. Decompression by needle, occasional operative incision of the calcium deposit, and x-ray therapy have been mentioned in the literature. We do not believe that these therapeutic measures are absolutely indicated in acute calcinosis. After all, because of the normal short acute episode, the efficacy of diathermy, x-ray treatment or similar procedures cannot be scientifically evaluated. The greatest danger from a functional point of view appears that many patients will continue physiologic rest, advised in the early acute stages, because of fear of pain or recurrence of symptoms. It is not difficult to visualize the serious consequences that may ensue in such individuals, namely, a partial or complete "frozen shoulder" or any other joint or area that may be involved. Physical therapy including therapeutic exercise is indicated following the acute stage, solely for the prevention of loss of function and residual deformities. The use of local heat in any form, massage, and an intensive program of active, assistance and graded, progressive resistive exercises, are definitely indicated in these patients. Not only should they be given a clear, complete program of therapeutic exercises to be pursued at home but from time to time re-evaluation with revision of such an exercise program as may be definitely indicated should be made, especially in the timid apprehensive individual. There is no question that many cases will require no physical therapy whatsoever because of the complete absence of any residual complaints and defects of function.

### Summary

The literature of the clinical course of a condition described as acute calcific calcinosis has been reviewed including some theories of its pathogenesis. There are



many problems and questions that remain unanswered as far as this pathologic process is concerned. It differs in various extremes from other conditions in which calcium deposits play a predominant role. The treatment of this acutely painful condition is extremely conservative, if not completely negative, and the post-acute therapy is directed towards the prevention of functional defects and deformities.

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# Isometric Exercises in the Paraplegic and in the Patient with Weakness of Quadriceps and Hamstrings

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● Earlier studies have demonstrated that isometric exercises were effective in increasing muscle strength and endurance. Tension development, and not anoxia, was responsible for the improvement in strength. In the following experiments the primary aim was to study the effect of isometric and isotonic exercises on muscle function in the upper and lower extremities. The triceps of paraplegic patients, and the quadriceps-hamstrings of patients with weakness of these muscles were investigated. In all studies one side was treated with isotonic exercises, while the contralateral extremity was treated isometrically. Isometric tension, 10 repetition maximum and integrated electrical activity of the muscle were recorded. Increase in 10 repetition maximum was always markedly and significantly greater than increase in isometric tension. In general, isometric and isotonic exercises produced similar improvement. In the few instances in which significant differences existed these were always in favor of isometric exercises. Maximal improvement in triceps function was generally achieved within five weeks. In the quadriceps and hamstrings, however, not only did increase in function continue during the entire period of study, but the magnitude of this increase was almost twice as great as in the triceps. The amount of triceps exercise, the factor of weight-bearing in the lower extremity, and electrical activity in the triceps were examined in order to throw some light on this difference between the two groups of muscles. None of these factors was found to be contributory.

Isometric exercises can produce an increase in strength in the normal subject which is as great as, or even greater than, that produced by standard progressive resistance isotonic exercises.<sup>1, 2</sup> Since the papers on which this premise is based were published, further evidence in this direction has been provided by studies carried out in other laboratories.<sup>3, 4</sup> One of these studies also was carried out on normal subjects,<sup>3</sup> while the other included patients with quadriceps weakness.<sup>4</sup> In the latter experiments the exercises were, however, only partially isometric.

Two questions were raised by these results: first, the nature of the mechanisms involved; and second, the ability of patients to respond as satisfactorily to isometric exercises. The first of these problems will be referred to only briefly here, since these results will be published in detail elsewhere.

There was much evidence to indicate that the prime factor responsible for this increase in strength was the tension developed by the contracting muscle during the exercise program.<sup>2, 5-7</sup> Yet, it was suggested, from time to time, that

anoxia might play a role in this strength increase.<sup>8</sup> Since intramuscular pressures are sufficiently high during a powerful contraction, especially when isometric, to completely arrest the blood flow, the significance of the consequent temporary anoxia during such a training program had to be explored. To test this hypothesis, isotonic exercises were carried out on normal subjects in our laboratories, under a situation in which tension was low and blood supply was impaired.<sup>9</sup> Ischemia of the exercising muscles was attained by occluding the arm proximal to these muscles with a cuff inflated to a pressure of 220 mm. Hg. Under these circumstances no increase in strength was produced after four weeks of exercise. Impairment of blood supply per se, during the exercise period, did not seem to be the primary cause of the subsequent increase in strength.

Further attention then was directed toward tension producing exercises — isometric exercises — in clinical situations. Previous studies with isometric exercises had been carried out on trained, normal subjects. In one clinically oriented study,<sup>4</sup> the exercises were only partly isometric. Since an isometric contraction with much tension development is not easy to achieve, requires careful explanation to the subject, and much cooperation by him, it was possible that the trained subject might learn this technic while the patient might not. Our initial purpose, in this study, was to compare isometric exercises with isotonic exercises under clinical circumstances and to determine whether, in the untrained patient, one type of

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exercise was superior to the other in the ability to increase isometric tension and 10 repetition maximum. Paraplegic patients and patients with weakness of the muscles stabilizing the knee were studied. It soon was evident, as will be described below, that isometric exercises were usable in clinical situations. It became apparent, however, during the course of this study, that a further problem was raised by unanticipated differences between the response of hamstrings and quadriceps and the response of the triceps. Our goal then was expanded to attempt to determine the nature of this difference.

### Method

1. Isometric tension was recorded with a cable tensiometer. These measurements, and the isometric exercises, were carried out on the Elgin table, in positions that will be described below. With the knee or elbow at the desired angle, the weight pan was fixed so that any contraction would be isometric. This was done by

tightening two pipe clamps three-fourths of an inch in diameter to the vertical guide bars just above the weight pan (fig. 1), thus preventing any rise in this pan on muscle contraction. If the tensiometer were then fastened to the cable (one-eighth inch diameter) from which the weight pan was suspended, it would record the tension developed during the isometric contraction.

2. The 10 repetition maximum was measured, using standard technics.

3. Electrical activity in the contracting triceps was determined with a portable transistor amplifier (fig. 2),<sup>10</sup> using skin electrodes placed 14 cm. apart on the posterior aspect of the arm. The amplifier unit consisted of a three stage difference amplifier with six transistors, a class B push-pull final stage with two transistors, a 12 ohm two and three-fourths inch speaker, and a 200 d.c. microampere meter. The base to base input impedance was 5000 ohms. Voltage gain for the first three stages was 103,000. At the gain used, the band width between half power frequencies was 39 to 4800 cycles per second. Weight of the entire unit was two and one-half pounds. Peak electrical activity during isometric contraction of the triceps was recorded. This indicated the relative level of the electrical signal at the input.

4. Exercise program. This was carried out on the Elgin table using the triceps in paraplegic patients, and the quadriceps and hamstrings in patients with disability of the knee or hip. At random, one extremity was used for isometric exercise while the contralateral extremity was used for isotonic progressive resistance exercise. In the lower extremity, the quadriceps and hamstrings on one side were treated in the same fashion, either both isometric or both isotonic. The progressive resistance exercise technic was standard, with 10 warm-up contractions at approximately one-half maximum, and 10 contractions at a maximal level, at a rate of 15 per minute. Isometric exercise consisted of five maximal contractions lasting five seconds each, with five-second rest periods intervening, without any warm-up period. Encouragement was part of the training

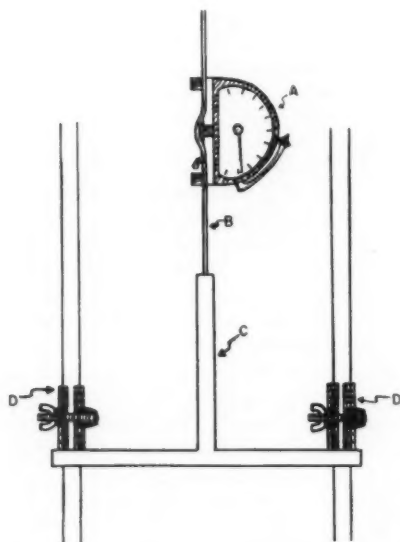


Fig. 1 — Diagram of the head of the Elgin Table, modified for measurement of isometric tension. A represents the tensiometer; B the  $\frac{1}{8}$  inch diameter cable; C the weight pan; and D the  $\frac{3}{4}$  inch pipe clamps.

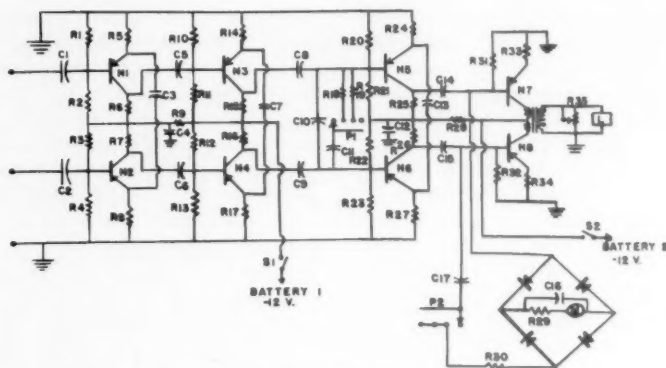


Fig. 2—Circuit diagram for transistor amplifier.

C 1, 2, 5, 6, 8, 9, 11, 14, 15, 17	10 microfarads	R 28	270 ohms
C 3, 4, 12	110 microfarads	R 29	5,000 ohms
C 7, 13	200 microfarads	R 30	2,700 ohms
C 10	.025 microfarads	R 33, 34	8.2 ohms
C 16	.2 microfarads	R 35	250 ohm potentiometer
R 2, 3, 11, 12, 21, 22	33,000 ohms	N 1, 2, 3, 4, 5, 6	2N192 transistors
R 1, 4, 10, 13, 31, 32	6,800 ohms	N 7, 8	2N187A transistors
R 5, 8, 14, 17, 19	2,000 ohms	S	double pole single throw switch
R 6, 7, 15, 16	3,900 ohms	P	double pole four position switch
R 9, 24, 27	1,000 ohms	T	.250 ohm - 8 ohm 350 mw transformer
R 18	630 ohms	L	12 ohm 2 3/4 inch speaker
R 20, 23	12,000 ohms	M	.200 d.c. microampere meter
R 25, 26	2,400 ohms		

program, but no word was said during the actual measurements. For the first few isometric exercise sessions only, the patient was taught maximal effort with the assistance of the tensiometer. For isometric exercises the position used was the one described below (similar to the position used for isometric testing), while for isotonic exercises the initial position was the same, but the patient then moved the limb through complete range. Exercises were performed daily except Saturday and Sunday. For the lower extremity exercises, the Elgin table was used only once each day. Triceps exercises on the Elgin table were done once or twice daily.

Position of the patient for Elgin table exercise. Triceps exercises for the paraplegic patient were done predominantly in the back-lying position with the table bent at an angle of 135 degrees at the level of the hips. The arm was adducted firmly to the chest wall, the elbow was flexed to 110 degrees (complete elbow extension being 180 degrees), and the forearm was pronated. Force was applied, both for exercise and for testing, from

the hand. A few patients, because of back instability, were exercised and tested in the completely supine position (no flexion at the hips). Other conditions were the same in both groups. Strapping was extensive during the period on the Elgin table so that movement at any other joint than the elbow would be minimal.

Quadriceps exercises were done in the sitting position, with the hip flexed to 90 degrees and the knee flexed to 90 degrees (complete extension at the knee being 180 degrees), with one exception. In one patient, quadriceps exercises were done at a knee angle of 140 degrees because of the patient's inability to flex beyond this point. Force was applied for exercise and testing at a strap just proximal to the lateral malleolus. Again strapping was used to prevent motion other than that at the knee.

Hamstring exercises were done in the prone position, with the head toward the foot of the Elgin table, the hip in neutral position, and the knee extended to 180 degrees. Force again was applied by means of a strap just proximal to the ankle joint.

5. Position for study of integrated electrical activity in the triceps. Two positions were analyzed in detail. One was similar to that used in the exercise program described above (back lying with hip flexed to 135 degrees). In the other position the long head of the triceps was placed on greater stretch, by forward flexing the arm 90 degrees in the sagittal plane. To achieve this the subject was seated at the foot of the Elgin table, facing the head of the table, with the elbow elevated in forward flexion and resting on the table. In both "supine" and sitting situations electrical activity and tension developed were determined during isometric contractions, with the forearm pronated. Recordings were made with force applied at the hand (as in the above studies on paraplegics) or with force applied at a cuff just proximal to the ulnar styloid.

6. Subjects examined. Triceps exercises and testing were performed in 16 paraplegics due to spinal cord trauma and one poliomyelitic paraplegic. Results with the latter patient were not included in the calculations to be reported, even though there was no apparent difference from the results obtained with the traumatic paraplegics. The traumatic paraplegic group consisted of nine males and seven females, ranging in age from 15 to 55, with an average age of 29. All in this group were placed on their exercise program within three months of their spinal cord injury, and none had any significant exercise from the time of injury until this program was begun. The time interval from injury to exercise was three months in three patients; 10 weeks in two patients; six to eight weeks in seven patients; and four weeks in four patients. The highest level of injury recorded (though others were examined) in this study was at the first thoracic vertebra. Other levels were at the fourth thoracic vertebra, one patient; the seventh thoracic vertebra, one patient; the 10th thoracic vertebra, three patients; the 11th, one patient; the 12th, three patients; the first lumbar vertebra, three patients; and the third lumbar vertebra, three patients.

For at least four weeks after the

exercise program for these paraplegics was begun, the only heavy resistance exercise for the upper extremities consisted of the triceps exercises on the Elgin table, once or twice daily. Gait training, pulley exercises, and transfer activities were omitted during this period, for the purpose of the study. In mat classes resistive exercises for the triceps also were omitted and the emphasis was on balance training. In eight patients (Group A) this regime, a "restricted exercise program," was continued for three more weeks. In the other eight patients (Group B) an "unlimited exercise program" was begun after the initial four weeks, introducing all those elements mentioned above and omitted in the first four weeks. The patient was encouraged to exercise as often as possible during the day. The Elgin table was resorted to only once weekly, for the purpose of triceps testing.

Quadriceps and hamstring exercises were performed in 12 patients who had weakness of these muscles. Assignment of the weak side to isometric or isotonic exercises was done at random. This group consisted of eight males and four females, ranging in age from 24 to 58 years, with an average age of 39 years. Four patients had patellectomy following patellar fracture; three patients had a meniscectomy; four had an acetabular fracture; and one had a fracture of the femoral neck. Four of these patients were not allowed to bear weight on one lower extremity during the period of observation, while two were on partial weight bearing.

Electrical studies and tension recording during triceps contraction were performed in 11 normal subjects, one male and 10 females. As noted above these were performed both "supine" and sitting, with force application at the hand or proximal to the wrist, and at elbow angles that varied from 60 degrees to 140 degrees (180 degrees complete extension), at 20 degree intervals. There was a rest of at least 60 seconds between contractions, and the order of testing at different angles was randomized.

### Results

1. In figure 3, the changes noted in paraplegics exercised for seven weeks on the Elgin table are recorded. The per cent improvement in the 10 repetition maximum was far greater than the improvement in isometric tension. At the beginning of treatment the 10 repetition maximum was, on the average, 47 per cent of the isometric tension, while after four weeks it was 66 per cent of the isometric tension. The rate of increase in 10 repetition maximum was initially slightly greater in the isotonically treated group, but the level reached, and maintained, after four weeks, was almost identical with both isotonic and isometric exercises.

Isometric tension also reached maximal improvement at four weeks, but unlike the 10 repetition maximum values, these fell slightly, but consistently, with continued treatment. The improvement following isometric exercises was greater than that resulting from isotonic exercises after the third week, and was of statistical significance ( $p = 0.05$ ).

Figure 4 shows the changes in isometric tension and 10 repetition maximum in the eight patients who were taken off the Elgin table after four weeks of exercise and placed on an "unrestricted exercise program." The results with isometric and isotonic exercises were, as in Group A, similar, and were therefore combined. The average increase during the first four weeks of exercise was a little higher in this group. The general pattern was, however, approximately the same in both groups. Plateauing of both 10 repetition maximum and isometric tension occurred at about the seventh week, later than in the first group. The significance of the drop in 10 repetition maximum during the first week that the patients were placed on unlimited activity is difficult to determine. Statistically there was no difference between these two groups, although improvement did seem to continue somewhat longer in the group on unrestricted exercise. In only one patient, G. M., was there continued improvement in both isometric tension and 10 repetition maximum during the entire period

of observation, which, for this patient, included four weeks on the Elgin table, and 14 weeks on unlimited exercise. In this patient the improvement in isometric tension after four weeks of exercise was 22 per cent, while the increase in 10 repetition maximum was 54 per cent — both fairly close to the average. By the 11th week the increase in isometric tension was 42 per cent and the increase in 10 repetition maximum was 97 per cent — both above the average for this group of paraplegic patients, and the levels were still increasing. Two patients improved further during the first week of unlimited exercise, and plateaued thereafter, while the remainder followed the pattern outlined in figure 3, reaching a level in 10 repetition maximum after the fourth week, with a slight decline in isometric tension at this time.

2. The results of exercise programs for hamstrings and quadriceps were not significantly different, and were therefore combined (fig. 5). Improvement in isometric tension was almost identical for the muscles treated isometrically and isotonically. Improvement in 10 repetition maximum was greater for the muscles treated isometrically ( $p = 0.05$ ). Some differences from the triceps group are apparent. First, the magnitude of the increase in both isometric tension and 10 repetition maximum was far greater than that noted in the triceps group ( $p < .001$ ), even for patient G. M. Second, there was no plateau in 10 repetition maximum during the seven week period of observation, but continued improvement. Isometric tension increase during the last few weeks was slight, and approached a plateau.

3. One of the problems which appeared was the greater improvement in quadriceps-hamstrings function than in triceps function. The possibility that the constant activity of the lower extremity during walking might account for the greater improvement in the lower extremity muscles was ruled out when it was noted that the six patients who were on no weight bearing or on partial weight bearing had improvement which was slightly, but not significantly, greater than that of the weight-bearing exercised



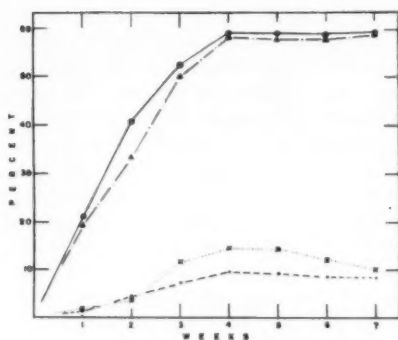


Fig. 3 — Effect of exercise on function of the triceps in paraplegic patients who were on Elgin table exercises for seven weeks. The ordinate refers to per cent improvement in isometric tension (X, ●) or in 10 repetition maximum (O, Δ); the abscissa refers to time in weeks. Isometric exercises are represented by crosses (X) and triangles (Δ); isotonic exercises by closed circles (●) and open circles (O).

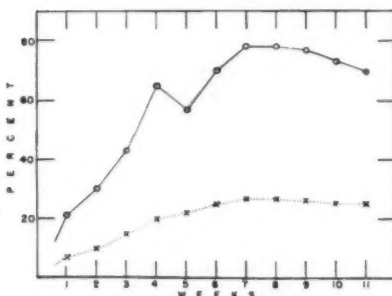


Fig. 4 — Effect of exercise on function of the triceps in paraplegic patients who were on Elgin table exercises for four weeks, and on unlimited exercise for seven additional weeks. The ordinate refers to per cent improvement in 10 repetition maximum (open circle, O), and in isometric tension (crosses, X); the abscissa refers to time in weeks.

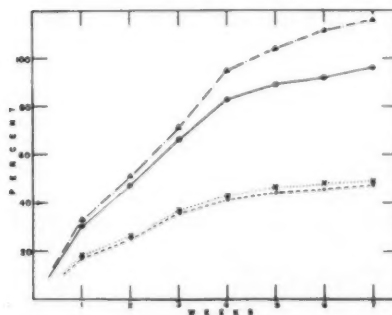


Fig. 5 — Effect of exercise on function of the quadriceps and hamstrings. Coordinates and symbols have the same significance as in figure 3.

lower extremities. These patients had no stress to hamstrings or quadriceps on one side except that which was presented by one period of isometric exercises daily. It did not seem as if the stress of walking during the period of the exercise program could account for the difference between triceps and quadriceps-hamstrings.

4. Electrical activity and tension were then studied in the triceps to determine whether the position used for exercise in the paraplegic was optimal. Different angles at the elbow, various positions of the arm, and different means of applying the force to the cable (pull by means of hand-grasp and pull from strap proximal to the wrist) were studied. Figure 6 shows the average tension and the relative electrical activity. The results were uniform, with significant increases in recorded tension as the angle at the elbow increased. The tension exerted in the "supine" position was greater than in the sitting position. The pattern of electrical activity was more variable, but certain generalizations could be made. No matter what the position ("supine" or sitting) or the manner of pull (from hand or wrist) the level of electrical activity was approximately the same from 60 degrees to 120 degrees (elbow angle), while the activity at 140 degrees was significantly smaller. The angle at which exercise was carried out in this study (110 degrees) thus was in the general

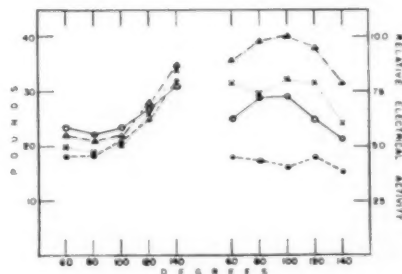


Fig. 6 — Effect of elbow angle, position of the subject, and method of pull on isometric tension and relative electrical activity in the triceps. The left ordinate represents isometric tension, in pounds; the right ordinate relative electrical activity; and the abscissa the angle at the elbow, in degrees. Triangles (Δ) represent data obtained in the supine position; closed circles (●) those obtained in the sitting position; crosses (X) represent values with pull from the hand; open circles (O) those with pull from the wrist.

region of maximal electrical activity noted. Furthermore, electrical activity in the triceps was moderately, but significantly, greater with hand than with wrist pull, and markedly greater in the supine than in the sitting position.

### Discussion

The question as to whether isometric exercises would be as valuable as isotonic progressive resistance exercises in the clinical situation could be answered in the affirmative. For triceps, quadriceps and hamstrings, the isometric exercises produced as marked improvement in isometric tension and in 10 repetition maximum as did the isotonic exercises. As a matter of fact, the increases produced by isometric exercises in isometric tension of triceps and in 10 repetition maximum of quadriceps-hamstrings were significantly greater than those produced by isotonic exercises ( $p = 0.05$ ). It might be noted that every patient felt that there was "harder work" in the heavy resistance exercises than in the isometric ones. Motivation and the feeling of better performance certainly could play little or no role in the results obtained. Factors involved in such improvement with isometric exercises, such as the tension developed and the rate of contraction, have been noted in a previous study,<sup>2</sup> while the relative insignificance of anoxia has been referred to earlier in this paper.

The ease of attaining good results with isometric exercises in patients, with minimal instruction, makes it a usable technic. The much shorter time element, in a busy therapy schedule, the desirability of carrying out exercises without joint movement,<sup>11</sup> and the ease of carrying out isometric exercises in a home program are distinct advantages presented by an isometric exercise program. It is conceivable, however, that carrying an extremity through its complete range may be a distinct advantage. Isotonic or isometric exercise may therefore be prescribed with the specific problems of the individual patient considered, realizing that strength and 10 repetition maximum may be improved with either.

It is apparent, as noted in earlier studies,<sup>2</sup> that isometric tension and 10 repetition maximum do not measure identical aspects of muscle function. Although both improve with both isometric and isotonic exercises, the magnitude of improvement in 10 repetition maximum is far greater than the increase in isometric tension, and there is a greater tendency for the isometric tension values to reach a plateau. As the test is performed there is no tendency for fatigue to follow isometric testing, whereas there is fatigue with 10 repetition maximum testing. Isometric tension probably depends primarily on cross sectional area of muscle although central nervous system factors may play some role. Ten repetition maximum, on the other hand, is more closely related to endurance factors, which involve circulatory changes within the muscle, and patterns of innervation.

Although the results showed an equivalent effect, from the practical standpoint, from isotonic and isometric exercises, the possibility of cross effects (cross education) from an exercised isotonic muscle to the contralateral isometrically exercised one had to be considered. Cross effects have been noted primarily in the sphere of coordination. In studies with heavy resistance or isometric exercises no cross effect has been noted in terms of improvement of strength of an unexercised extremity.<sup>2, 8, 12, 13</sup> In a previous study,<sup>14</sup> it was reported that during isotonic exercises of the biceps, electrical activity was noted first in the contralateral triceps, and not the contralateral biceps. In this study, a few experiments were carried out on normal subjects to determine the electrical activity within the triceps, using the technic described earlier in this paper. When the contralateral triceps contracted against heavy resistance, there was no discernable electrical activity in the inactive triceps which was under examination. When the contralateral triceps contracted isometrically, the triceps under examination showed electrical activity which was only three per cent of the maximum which could be obtained during its own isometric contraction. It is felt, therefore,

that the improvement obtained in the isometrically contracting muscle, in this study, was the result of intrinsic activity, and not contralateral activity.

The other problem raised, but not satisfactorily answered, was the difference between the magnitude of improvement in the quadriceps-hamstrings and in the triceps. It was felt at first that the much greater stress on muscles of the lower extremities occasioned by walking and stair-climbing, in addition to the heavy resistance program undergone once daily, might account for the much better results obtained in the quadriceps and hamstrings. That this was not a likely explanation became apparent when it was noted that improvement rate was as great in the nonweight-bearing extremity, which was exercised only once daily, as in the weight-bearing lower extremity.

The factor of age did not seem to favor the lower extremity group, for these patients were, on the average, slightly older than the paraplegics. Several of the patients who had lower extremity exercises were in bed for only short periods of time or for no time at all before the exercise program was begun, and had one extremity that was essentially normal in strength. The per cent improvement in these was only slightly less than for the entire group, suggesting that one could not attribute any superiority in quadriceps-hamstrings results to a start at a lower level of performance. Whether the severity of trauma in the paraplegic patient could play any role in the response of the triceps to an exercise program could not be determined.

It then was considered possible that the position of the arm and forearm during exercise might not be optimal for the purposes of increasing strength and endurance. It was assumed that the development of maximal tension was desired for achievement of the goal in view, and that electrical activity in any one subject would be a good index of tension developed.<sup>15</sup> On examination of various positions — "supine," prone, and sitting — of different angles at the elbow, and of pull from wrist or hand, it was determined that the exercises performed

in this study were performed in the best set of conditions of all tested. This does not, of course, exclude the possibility of a better technic for triceps exercise to be found in the future.

Of interest, but tangential in importance to the main purpose of this study, is the greater electrical activity in the triceps on pulling from the hand than from the wrist. This is undoubtedly related to the synergic effect of hand grasp on triceps contraction in the pronated position. The much greater activity in the "supine" rather than in the sitting position is probably due to the greater stability in the former position. The greater ability to develop tension when stabilization was securely achieved has been noted on several occasions.

Apparently similar amounts of exercise thus produced lesser effects in terms of tension and endurance in the triceps than in the quadriceps-hamstrings, with no apparent reason. It then was felt that the stress of almost continual exercise might be needed by the triceps. Examination of the "unlimited exercise" group, after four weeks of Elgin table was done with this in mind. During this unlimited exercise period the patient was encouraged to be active during as much of the day as possible. There was intensive transfer activity, mat exercises, pulley exercises, and gait training for progressively longer periods. Yet, with the exception of one patient, G. M., there was no real difference between the pattern of improvement in this group and the group which remained on Elgin table exercises for seven weeks. The improvement in patient G. M. was far greater than that of the other paraplegics, but still less than that of the quadriceps-hamstrings group of patients. It might be noted that G. M. had an unusually high degree of motivation, was physically active to a much greater degree than the other paraplegics, and that the extra work on his part was predominantly in ambulation (swing-through gait). It is possible that this period of unlimited exercise in the paraplegic has neuromuscular values other than those which are measured by isometric tension and

10 repetition maximum. Yet, in the light of the present studies, it will be necessary to search specifically for these gains to determine when the maximal value of paraplegic training has been reached, from the neuromuscular standpoint.

One can only speculate concerning the mechanisms responsible for the difference between triceps and quadriceps-hamstrings. Intrinsic differences in such factors as innervation or blood supply are possible. It is likely — but not yet proved — that muscles utilized in daily constant and heavy activity, such as walking, would have a more adequate circulation and metabolism than muscles, like the triceps, which do not normally have such daily stress. Adequacy of circulation can certainly limit the degree of hypertrophy and tension increase which would follow an exercise program of the type utilized in this study.

### Summary

1. The triceps in paraplegic patients and the quadriceps and hamstrings in patients with disability of hip or knee were treated with isotonic (progressive resistance exercises or with isometric exercises. Isometric tension and 10 repetition maximum were recorded at weekly intervals during this exercise program.

2. Improvement in muscle function was essentially the same after isotonic and isometric exercises. In the few instances in which significant differences existed, these were always in favor of isometric exercises.

3. Increase in 10 repetition maximum was always markedly and significantly greater than increase in isometric tension.

4. The magnitude of the increase in function of hamstrings and quadriceps was much greater than the increase in triceps function.

5. Several factors, including electrical activity in the contracting triceps, were examined in order to throw some light on this difference between upper and lower extremity muscles studied, but no satisfactory explanation was forthcoming.

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# Paramyotonia Congenita, Clinical Features and Electromyographic Findings

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● The purpose of this paper primarily is to present electromyographic findings in several cases of paramyotonia congenita, before, during, and after exposure to cold. In addition, the clinical symptoms and description are reviewed and the genetic chart of one family brought up to date. Paramyotonia congenita is a hereditary disease involving the neuromuscular system and manifested principally by paralysis of muscle groups exposed to cold. This reaction is reversible by heating. This disease apparently is only transmitted by a parent who also has the disease and is not known to occur in children where both parents are free of the disease. The symptoms of paramyotonia congenita are evident in infancy. They are not progressive with age nor is the longevity of the individual with paramyotonia congenita affected. These people apparently live a reasonably normal social and economic life. Electromyographically, certain abnormal potentials are evident similar to myotonic potentials. These are most evident in the small muscles of the hands and feet. These potentials and all other electrical activity disappears in the muscle when it becomes "paralyzed" due to cold.

The purpose of this paper primarily is to present electromyographic findings in several cases of paramyotonia congenita, before, during, and after exposure to cold. In addition, the clinical symptoms and description will be reviewed and the genetic chart of one family brought up to date.

As far as can be determined, this condition was first described by Eulenburg<sup>1</sup> in 1886. Professor Eulenburg, of Berlin, was able to trace the disease through six generations and presented a genetic chart in his original paper. In 1894, a Dr. Ezra Clark Rich<sup>2</sup> of Ogden City, Utah, described a condition as "a unique form of motor paralysis due to cold" which actually conformed to Eulenburg's paramyotonia congenita. Dr. Rich was aware of the similarity of this paralysis to Thomsen's Disease but apparently was not aware of Eulenburg's description in 1886. Dr. Rich described the clinical symptomatology in great detail and presented a genetic chart. Most of the members of the family that Dr. Rich described lived in the Idaho and Utah area, and they were able to trace the disease back to an ancestor from Connecticut. Dr. F. E. Stephens<sup>3</sup> made a more complete genetic chart in 1953 of the same family that was described by Rich. His observations of the clinical aspects of the disease were

essentially the same as those of Dr. Rich. Dr. Stephens describes this particular genetic pattern as "an excellent example of a simple autosomal dominant trait."

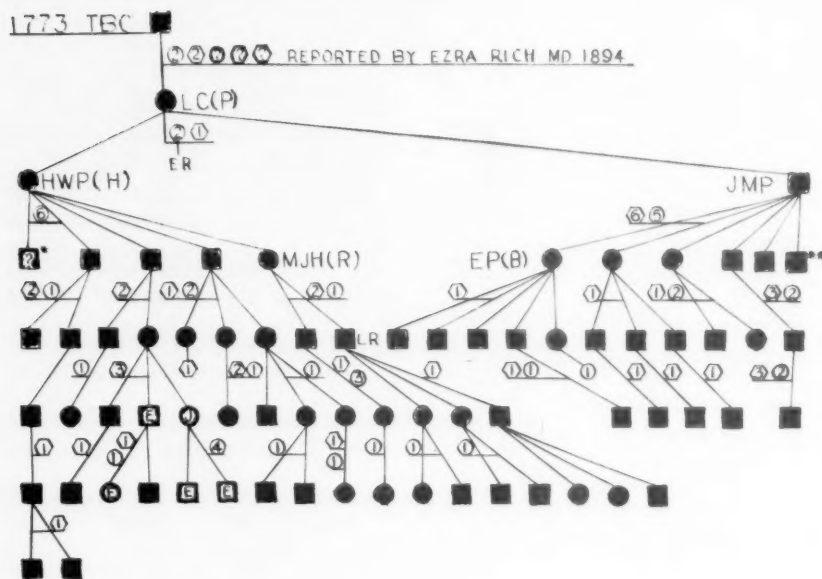
The genetic chart (table 1) accompanying this paper was initially made up without any reference to the charts prepared by Drs. Stephens and Rich. As this is a Mormon family, detailed family histories could be traced back to 1773. The chart was prepared from information received by a present-day member of this family who herself is affected by the disease. From this study, tracing the disease back to the original ancestor used by Drs. Rich and Stephens, this author was able to document 72 affected individuals, 46 males and 26 females. There were 81 unaffected individuals, 40 males and 41 females. By a comparative study of this genetic chart with that produced by Dr. Stephens, and the original produced by Dr. Rich, approximately 16 more cases were discovered, giving us an approximate total of 88 documented cases in all. It is evident from this genetic study that one has about a 50-50 chance of inheriting the disease in this family, and that males are affected approximately twice as often as females. The distribution of male and female in the unaffected persons was essentially equal. As has always been noted in descriptions of this disease, once an individual is unaffected, this is the end of the heredity of the disease; so that all further offspring of the unaffected individual will be free of the disease, and only an affected individual can have an affected offspring.

Members of this family call the disease the "numbness." On exposure of a part to cold, such as the hands or face; a

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Table 1: Paramyotonia Congenita Genetic Chart

Solid squares represent affected males; solid circles represent affected females; hexagon represents number of unaffected males; open circles represent number of unaffected females; lettered squares represent EMG subjects; lettered circles represent informants and EMG subjects; one asterisk represents subject believed to have paramyotonia but no affected children; two asterisks indicate subject died age 2½ years; initials are for family identification.



stiffness is produced in the muscle so that the individual is unable to move it and they experience a numb sensation. There is, however, no actual sensory loss. This stiffness and inability to move may last a few minutes to several hours, but is characteristically relieved by warming the part. Oftentimes the individuals can feel the "numbness" coming on and prevent actual muscle paralysis or the myotonic reaction by exercising the part. Cooling following excessive perspiration, either from exercise or heat, also can in itself produce the symptoms without the presence of a truly cold environment. General fatigue, nervous tension, and hunger have all been described by members of the informant's family as predisposing one to the paramyotonic reaction. Muscles unexposed are not affected. The muscles of the tongue and throat, however, can be "paralyzed" by eating ice cream and drinking cold liquids. Where the parents are aware of the disease in the family, they can readily recognize its presence in their children,

even in infancy. The disease is non-progressive and non-disabling; these people live a full normal, useful life.

### Method

The electromyographic studies were done on the informant, a 31-year-old white female, her 41-year-old brother, the informant's children and one child of her brother. An electromyograph with a single needle electrode was used in all the experiments. The exact procedure followed and the electromyographic settings will be described in detail in each experiment.

### Electromyographic Findings

The myotonic, paramyotonic, or "dive-bomber" potentials described by Shea<sup>4</sup> usually were immediately produced on the insertion of the electromyographic needle in the muscle. The patient was able to relax sufficiently to produce electrical silence in the muscles; however, further needle movement then caused



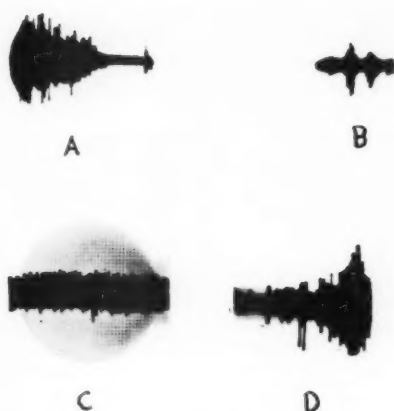


Fig. 1 — Sweeptime 1000 ms./in.; amplification 200 mv./in.; characteristic of paramyotonic potentials.

successive myotonic bursts, a longer burst is demonstrated in C, and both B and D demonstrate the rapidity in which the amplitude of the burst is built up to a peak, sometimes with a rapid decrease but usually with a gradual decrease of amplitude. Peak amplitude of the individual bursts here varied approximately from 100 to 1,000 microvolts. Figure 2 was taken at a sweeptime of 200 milliseconds per inch with an amplitude of 200 microvolts per inch. In figure 2A, we see the beginning of a second myotonic burst, superimposed on its predecessor; it demonstrates the marked regularity of the interval between the wave forms composing the myotonic bursts. Figure 2B gives us the impression of a very gradual regular decrease of the



Fig. 2 — Sweeptime 200 ms./in.; amplitude 200 mv./in.; characteristics of paramyotonic potentials.

bursts of myotonic potentials and voluntary effort itself also caused the production of these bursts. In peripheral muscles such as the abductor minimi digiti, normal motor unit activity was for the greater part obliterated by myotonic type potentials on voluntary effort. It was also a general impression of this examiner that the myotonic activity was more evident in the peripheral musculature, as the small muscles of the hand and feet, than in the larger musculature of the arms, thighs, and calves. In observing many bursts, it was noted that they lasted anywhere from approximately a half second up to as long as eight seconds. Bursts frequently were successive, being superimposed one on the other. The electromyographic tracings taken in figure 1 were recorded at a sweeptime of a thousand milliseconds per inch with a 200 microvolt per inch amplification. Figure 1A shows the end of a single burst. Figure 1B shows

interval between each wave form as the myotonic burst approaches its completion; this, however, is unusual. Figure 3 was taken at an amplitude of 200 microvolts per inch with a sweeptime of 30 milliseconds per inch. Here, more details of the exact wave forms of the myotonic bursts can be seen, and it is noted that they maintain their essential characteristic wave form throughout the burst. However, as can be seen in A, B, C, and D, of figure 3, there is quite a variance between the wave forms. Thus no true characteristic wave form can be described for these myotonic bursts, yet they do have certain common characteristics, the most striking of which is their "dive-bomber sound." This has been a general description of the paramyotonic potentials noted in two adults and two children with known paramyotonia congenita.

The experiments with cold were only performed on the two adults. The pa-

tient's hand was immersed in ice water. Prior to the immersion, electromyographic examination was made in the abductor minimi digiti. The potentials seen on voluntary effort are noted in figure 4A, taken at a sweeptime of 30 milliseconds per inch and 200 microvolts per inch amplitude. After 15 minutes of immersion in ice water, the hand was removed and dried, and the electromyogram again inserted in the abductor minimi digiti. No electrical activity whatsoever could be elicited on needle movement, passive stretch, or on attempted voluntary effort. The immersion in the ice water had produced an ulnar nerve lesion type of deformity with a flexion of the ring and little fingers and loss of ability to extend these fingers. The hand was then placed

in hot packs for 30 minutes and at the end of this time movement had returned to the fourth and fifth fingers but the patient still had a subjective feeling of weakness. Figure 4B demonstrates the motor unit activity present on voluntary effort at this time. Myotonic activity was much less in evidence on voluntary effort, figure 4C, and needle movement, figure 4D.

A second experiment consisted of electromyographic examination of the abductor minimi digiti prior to, during, and after immersion of the elbow in ice water. Here the tested muscle itself is not directly exposed to cold, but indirectly through the circulation from the elbow. Figure 5 was recorded at the usual amplitude of 200 microvolts per inch with a sweeptime of 30 milliseconds. Figure 5A demonstrates the activity on the original needle insertion into the abductor minimi digiti. In figure 5B, hyperirritability continues in spite of the patient's efforts to relax. After 10 minutes of immersion of the elbow in the ice water, the patient developed the same type of flexion deformity of the fourth and fifth fingers, and in addition the index finger was also held in the flexed position. The patient was still able to voluntarily extend these fingers and myotonic bursts were still evident. After a total of 25 minutes of immersion, the patient completely lost the ability to extend the fourth and fifth fingers, and figure 5C demonstrates the activity on needle movement at this time, and figure 5D the activity on voluntary effort. At this time, the elbow was removed from the ice water and the needle placed in the common extensor musculature of the forearm at a depth of one centimeter. As noted in figure 6A, no electrical activity at all could be elicited, either on needle movement, passive stretch, or attempts at voluntary movement. The needle was then inserted more deeply at a two and three centimeter level and myotonic activity was evident, as in figure 6B. The elbow area was then heated with a 500 watt tungsten infrared lamp, and after 15 minutes of heating at 20 inches distance, there was no return of any electrical activity. The lamp was

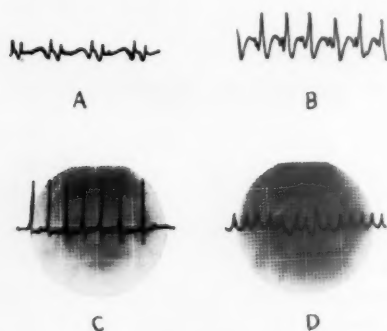


Fig. 3 — Sweeptime 30 ms./in.; amplitude 200 mv./in.; characteristics of paramyotonic potentials.

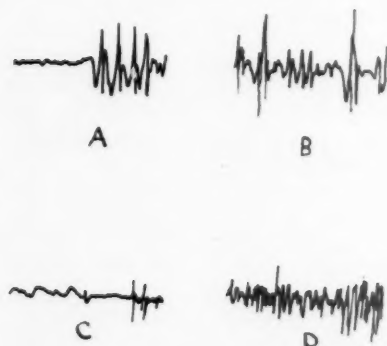


Fig. 4 — Sweeptime 30 ms./in.; amplitude 200 mv./in.; experiment demonstrating effect of cold by direct immersion in ice water and the effect of heating the chilled muscle.

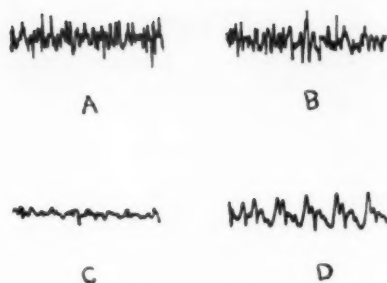


Fig. 5 — Sweep time 30 ms./in.; amplitude 200 mv./in.; experiment demonstrating the effect of cold by direct chilling.

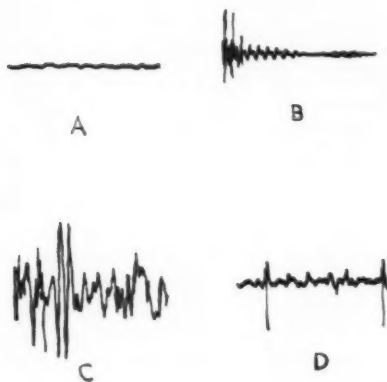


Fig. 6 — Sweep time 30 ms./in.; amplitude 200 mv./in.; experiment demonstrating the effect of cold on superficial and deep musculature and the effect of heating the chilled muscle.

then moved to 10 inches, and then after six more minutes, motor unit activity on voluntary effort was seen at the one centimeter level over the common extensor musculature and this is recorded in figure 6C. As the heating period continued, more and more voluntary motor unit activity on voluntary effort, and more myotonic potentials on needle movement became evident. However, voluntary movement did not so readily produce myotonic bursts and single motor unit activity as in 6D was more frequently seen.

Brief ethyl chloride spray sufficient in degree to freeze the skin over the abductor minimi digiti did not influence the myotonic activity or produce paramyotonic symptoms.

A normal control subject immersed the hand and forearm in ice water for 25 minutes. There was no diminution or loss of voluntary motor unit activity on voluntary effort at the end of this time.

### Conclusion

From the experiments conducted, the following conclusions and observations may be drawn. (1.) Paramyotonic bursts last approximately one-half to eight seconds with peak amplitudes between 100 and 1,000 microvolts. (2.) A single paramyotonic burst was characterized by sudden crescendo of relatively high amplitude with the gradual decrease of amplitude as the burst died out. (3.) The wave forms which make up the paramyotonic burst occur in regular series, and at more or less regular intervals and maintain essentially the same wave form throughout the burst. (4.) The individual potentials which make up a burst may simulate a series of positive spike potentials, or may appear as biphasic or triphasic wave forms. (5.) With the application of cold for a sufficient length of time, all electrical activity, voluntary and otherwise, can be completely obliterated producing in essence a temporary paralysis of the muscle. This seems to be brought on by the actual cooling effect on the muscle, as merely freezing the skin with ethyl chloride spray failed to produce this effect. The application of cold or cooling of the muscle gradually causes the paramyotonic potentials to be reduced in number; normal unit activity becomes more easily distinguishable, but this also ultimately disappears.

The question, of course, remains whether the cooling produces its effect by action on the motor nerve ending, the end plate, or muscle fiber.

### Summary

Paramyotonia congenita is a hereditary disease involving the neuromuscular system and manifested principally by paralysis of muscle groups exposed to cold. This reaction is reversible by heating. This disease apparently is only transmitted by a parent who also has the disease and is not known to occur in

children where both parents are free of the disease. The symptoms of paramyotonia congenita are evident in infancy. They are not progressive with age nor is the longevity of the individual with paramyotonia congenita affected. These people apparently live a reasonably normal social and economic life.

Electromyographically, certain abnormal potentials are evident similar to myotonic potentials. These are most evident in the small muscles of the hands and feet. These potentials and all other electrical activity disappears in the muscle when it becomes "paralyzed" due to cold.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.



He who has health, has hope; and he who has hope, has everything.

— ARABIAN PROVERB

# Pressure-Volume Relationships in Emphysema Patients Before and After Breathing Exercises

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and  
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● Intraesophageal pressures and measurements of respiratory volume were made in six patients with pulmonary emphysema, before and after one month of breathing exercises. Measurements of total work, elastic work, non-elastic work, and active expiratory work per liter were made. Symptomatic improvement, in terms of decrease in dyspnea, was reported by five patients. Decreases in all phases of work except for elastic work were produced by Isuprel, although only the decrease in active expiratory work was statistically significant. Although there were no statistically significant changes in work after one month of breathing exercises, there was a strong tendency toward an increase in all work aspects except for elastic work.

The breathing exercises currently used for the management of patients with pulmonary emphysema and allied chronic respiratory conditions are basically similar to those proposed by the Asthma Research Council.<sup>1</sup> These exercises were developed empirically and the benefits noted have been largely subjective.<sup>2-4</sup> Objective evaluation of the effects of breathing exercises with study of muscle function by fluoroscopy<sup>5</sup> and electromyography,<sup>6</sup> and study of ventilatory function by tests of lung volumes, flow rates, distribution of gas, and gas exchange<sup>5-8</sup> has not demonstrated significant changes.

It has been suggested<sup>9</sup> either that the benefits of breathing exercises are psychologic, or that the significant and pertinent objective evaluation has not yet been made. One such aspect is the work of breathing. Evidence is accumulating which seems to indicate that increased work of breathing is an important factor in the disability produced by emphysema.<sup>10-13</sup> Christie<sup>11</sup> found the work of breathing to be within normal limits in emphysema patients at rest. After voluntary hyperventilation or exercise, however, the work of breathing increased above normal. He suggested that dyspnea might be related to this increased work. Cherniak<sup>10</sup> also reported that work of breathing in emphysema patients was increased and that it could be decreased by the administration of Isuprel.

Ventilation of the emphysematous lung is accompanied by abnormally large fluctuations

in transthoracic pressure.<sup>14</sup> When pressure and volume are related in one respiratory cycle, a loop (fig. 1-AIBE) may be plotted. The area of this loop, which represents the work required to overcome frictional resistance, is larger than normal in the emphysema patient. This loop represents energy dissipated as heat during the cycle.<sup>15</sup> Furthermore, because of decreased elastic recoil and increased resistance to air flow in emphysema, expiration may become active and the expiratory loop will then fall to the left of the ordinate in the pressure-volume plot (outside of triangle ABC in fig. 1).

Because of the increased respiratory work in emphysema, the possible relation of dyspnea to this increase in work, and the relief of dyspnea after breathing exercises, it seemed valid to investigate the effect of breathing exercises on ventilatory work. It seemed possible that some of the benefit derived from these exercises might be due to an effect on this work.

## Method

### A. Apparatus

#### 1. Measurement of Transpulmonary Pressure

*Gauge.* Transpulmonary pressure was measured by a Statham differential pressure transducer (Model PS-ID-240). Oral pressure was measured at the reference pressure connection, which was

This paper is an abridgment of the thesis submitted by Captain McKinley to the faculty of the Graduate School, University of Colorado, in partial fulfillment of the requirements for the degree of Master of Science in Physical Medicine and Rehabilitation (Physical Therapy).

This material has been reviewed by the Office of The Surgeon General, Department of the Army, and there is no objection to its presentation and/or publication. This review does not imply any endorsement of the opinions advanced or any recommendation of such products as may be named.

Captain, Army Medical Specialist Corps; Staff Physical Therapist, Fitzsimons General Hospital.

From the Department of Physical Medicine and Rehabilitation, University of Colorado, School of Medicine.

attached by a short length of rubber tubing to a copper fitting taped into the mouthpiece of the spirometer. Intraesophageal pressure was measured at the gauge pressure connection, which was attached by polyethylene tubing to an intraesophageal balloon.

**Balloon.** A latex balloon, manufactured by the Playtex Company, having thickness of 0.005 cm., was fitted over the end of a polyethylene tube 80 cm. in length, which was perforated for 12 cm. by about 20 spirally arranged holes. The open end of the balloon was secured to the tubing with Pliobond. Pliobond is manufactured by the W. J. Ruscoe Company.

**Tubing.** Before attaching the tubing to the transducer two to four milliliters of gas were introduced with a syringe. At this inflation the balloon remained flaccid and presumably its mechanical properties did not contribute to the pressure recording.<sup>16</sup> In order to minimize phase lag distortion, helium rather than air was used.<sup>17</sup> Fry<sup>17</sup> found that tubing with inside diameter of 0.177 cm. and outside diameter of 0.280 cm. was the smallest which would allow a resonant frequency well above the fastest components to be measured. Since comparable equipment was used in this study, identical tubing was selected. The system was optimally damped by cutting the number 15 needle attaching the tubing to the transducer to a one centimeter length.

**Recorder.** Pressure signals from the transducer were fed into a sanborn Carrier preamplifier (Model 150-1100).

## 2. Measurement of Volume

Volumes were recorded on a Collins Stead-Wells spirometer from which the soda lime container had been removed. Since the particular instrument used does not have a counterpoise pulley incorporated into its design, a circular linear potentiometer could not be added. Because some method of time correlation between pressure and volume recordings was necessary, a variable slide-wire resistance potentiometer was improvised. This was mounted on the plastic spirometer bell, and upward and downward movement of the bell during

respiration could be recorded electrically with a Sanborn AC-DC preamplifier (Model 150-1000). Coordination, in time, of volume and pressure changes was then possible.

## B. Experimental Procedure

**Patient Selection.** Six patients with the diagnosis of pulmonary emphysema, based on history, physical examination, and studies of ventilatory function, were selected. None of these patients had learned breathing exercises before this study.

On the first visit the patient rested for five to 10 minutes while the procedure was explained. A chilled balloon was introduced nasally without prior anesthetization of the nasopharynx. Petit<sup>16</sup> obtained identical results with and without anesthesia using either nasal or oral methods of introduction. The patient was encouraged to let cracked ice melt in his mouth and to keep swallowing while the balloon was passed into the stomach. The pressure recording was observed as the balloon was then slowly withdrawn. An abrupt change in pressure toward greater negativity on inspiration indicated that the balloon was above the cardiac sphincter.<sup>18</sup> Further repositioning of the balloon or patient was usually sufficient to eliminate artifacts of heartbeat or esophageal activity. The patient was seated during the test, with neck and shoulders as relaxed as possible. Pressures corresponding to a range of tidal volumes and fast vital capacities then were recorded. The length of tubing introduced was measured after the balloon was withdrawn, so that the same level would be reached on subsequent testing.

Because most of these patients were maintained on a bronchodilator, the response to Isuprel (brand of Isoproterenol hydrochloride) was tested. A 1:100 solution of Isuprel, diluted with an equal amount of distilled water, was applied orally with a hand nebulizer. After five minutes the above tests were repeated.

Patients were instructed in their homes three times weekly for one month in a breathing exercise program similar to that advocated by Miller.<sup>4</sup> Briefly the



goal of this program was to: relax accessory muscles of inspiration; prolong expiration; encourage voluntary contraction of the abdominal muscles and diaphragm; and correct postural defects. They were encouraged to practice the exercises repeatedly during the day and to attempt to correlate breathing with walking, stair climbing, etc.

After one month of breathing exercises, the patient was retested. In order to differentiate the long term effects from the immediate effects of breathing exercises, he was instructed to avoid use of breathing exercises and any bronchodilator on the day of retesting. Pressures corresponding to a range of tidal volumes and fast vital capacities were recorded after the patient had rested five to 10 minutes. These tests were repeated after breathing exercises were performed for about ten minutes.

#### Method for Analyzing Data

Pressure-volume "loops," using data obtained from polygraph and spirogram, were plotted for a single breath representative of pressure fluctuations encountered in a given range of tidal volumes. Pressures and volumes at the beginning and end of inspiration, the end of expiration, and points of high and low pressure were included in each loop. Other points were determined as necessary to fully characterize the pressure-volume relationship. Compliance

values also were determined.

The work of inspiration, area AIBC (fig. 1), was measured with a planimeter. The elastic work area ABC, was similarly measured and subtracted from area AIBC to determine the non-elastic work, area AIB. The work of the active expiration, that area falling to the left of AC, was measured and added to the work of inspiration to determine the total work per breath. Because tidal volumes were not identical, the work per liter was determined from the ratio of work to tidal volume.

For each individual and in every test situation all values for total work per liter and its components were expressed as the per cent of total work per liter in the initial test before Isuprel.

#### Subjective Results

Of the six patients who were instructed in breathing exercises, five learned them in a manner that was apparently satisfactory in terms of the goals searched for. All five reported an increase in "exercise endurance" and a decrease in shortness of breath. The sixth patient was able to perform exercise-type breathing in a resting situation, but resorted to hyperventilation with excessive use of accessory muscles after exercise. He felt that breathing exercises had not helped him in terms of relief of symptoms.

#### Work of Breathing

Changes in work per liter after Isuprel and after a breathing exercise program are summarized in table 1. Elastic work showed very little change in any test situation. After the administration of Isuprel, there was an average decrease in total work, non-elastic work and active expiratory work. Of these, only the last was statistically significant. Four of the patients showed a decrease in total work and non-elastic work.

After one month of breathing exercises, but before any exercise on the day of testing, two patients showed a marked increase in total work and all its components. Figure 2 shows the pressure-volume relationships for these two patients. Two others showed a slight decrease in total work and its components.

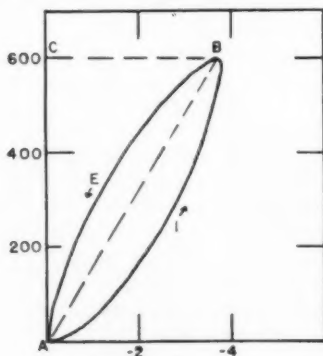


Fig. 1 — Dynamic pressure-volume diagram of the normal lung. AIB represents the inspiratory phase, BEA the expiratory phase. The ordinate represents the volume change, in millimeters, the abscissa the transpulmonary pressure, in centimeters water.

Table 1: Mean Percentage Change in Work per Liter in Patients with Emphysema

	After Isuprel	After One Month of Breathing Exercises	
		Before Breathing Exercise on Test Day	Immediately After Breathing Exercises
Total Work/L. ....	-18 ± 28*	+13 ± 55	+25 ± 32
Elastic Work/L. ....	+3 ± 6	-1 ± 4	0 ± 4
Non-Elastic Work/L. ....	-13 ± 27	+6 ± 24	+10 ± 17
Active Expiratory Work/L. ....	-8 ± 5 <sup>1</sup>	+6 ± 32	+16 ± 26

<sup>1</sup>P < .02 Other changes were not significant.

\*Figures represent the mean ± one standard deviation.

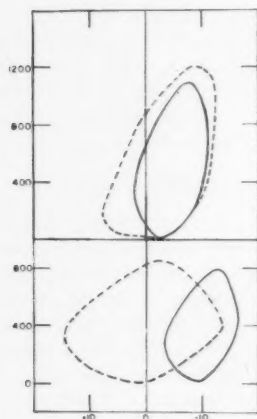


Fig. 2 — Pressure-volume diagrams in two patients before (solid line) and after (broken line) a month of breathing exercises. Coordinates as in figure 1.

One patient showed a decrease in total work and non-elastic work and an increase in the work of active expiration and another showed an increase in total work and non-elastic work and essentially no change in the work of active expiration. The mean percentage increase in total work per liter, non-elastic work per liter, and active expiratory work per liter was not statistically significant, however.

Immediately after breathing exercises two patients showed an increase in total work and its components. Two others showed a decrease in total work, an increase in non-elastic work and a decrease in work of active expiration. Two patients showed an increase in total work and work of active expiration, and a decrease in non-elastic work. The mean percentage increase in total work per

liter, non-elastic work per liter, and work per liter of active expiration was much greater than before exercises, on the same day, but still not statistically significant.

### Discussion

Areas corresponding to the total work per breath and to the work of active expiration were found to be relatively independent of compliance. Loops of comparable area, having different values for compliance, could be plotted for a single breath and for a range of tidal volumes. These loops had the characteristics described by others<sup>10, 12</sup> for emphysematous patients as opposed to those for normal subjects. The finding that the work of active expiration was significantly reduced after Isuprel has been reported previously.<sup>10</sup>

The increases in total work, in non-elastic work, and in expiratory work, per liter of ventilation after one month of breathing exercises and immediately after breathing exercises, though not statistically significant, are sufficiently high to excite suspicion. It may be that this reflects merely the known day to day variability in the work of breathing in the emphysema patient. Because of this variability, this work should be viewed only as a preliminary study, and a larger controlled series of observations is urgently needed. However, it may be that emphasis upon prolonged active expiration in exercise breathing was responsible for the more positive pressure excursions noted after one month of breathing exercises, and particularly, immediately after breathing exercises.

Furthermore, the increase in active expiratory work may very well be an integral part of any beneficial role that breathing exercises may have. This too, of course, is highly speculative and awaits more detailed observation for confirmation or negation.

Symptomatic improvement following breathing exercises will still lead one to lean heavily on this technic in managing the patient with obstructive pulmonary emphysema, though the mechanisms for such improvement still remain unclear.

### Summary

1. Intraesophageal pressures and measurements of respiratory volume were made in six patients with pulmonary emphysema, before and after one month of breathing exercises.

2. Measurements of total work, elastic work, non-elastic work, and active expiratory work per liter were made.

3. Symptomatic improvement, in terms of decrease in dyspnea, was reported by five patients.

4. Decreases in all phases of work except for elastic work were produced by Isuprel, although only the decrease in active expiratory work was statistically significant.

5. Although there were no statistically significant changes in work after one month of breathing exercises, there was a strong tendency toward an increase in all work aspects except for elastic work.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.



# *Important-*

to members of the

## **AMERICAN ACADEMY OF PHYSICAL MEDICINE AND REHABILITATION**

The Nominating Committee of the American Academy of Physical Medicine and Rehabilitation, being well aware of the obligations placed upon it and after careful consideration, unanimously recommends and nominates the following Academy members for election to the named offices.

**President-Elect**

**MAX KARL NEWMAN**  
Detroit, Michigan

**Vice-President**

**MORTON HOBERMAN**  
New York, New York

**Secretary**

**HARRIET E. GILLETTE**  
Cleveland, Ohio

**Treasurer**

**JAMES W. RAE, JR.**  
Ann Arbor, Michigan

**Board of Governors**  
(three year term)

**MICHAEL M. DACSO**  
New York, New York

The offices listed are those elective offices that are vacant or will be vacant at the close of the 1961 annual session. The office of President will be automatically assumed by the President-Elect, Robert W. Boyle. The office of immediate Past-President will be automatically assumed by the present President, Ray Piaskoski. The present incumbent elected members of the Board of Governors, Herman L. Rudolph and A. B. C. Knudson, will have terms of one year and two years, respectively, of service on the Board after the 1961 annual session.

This slate of nominees is submitted in accordance with Article XII, Section 3(c) of the By-Laws.

*Respectfully submitted,*  
**NOMINATING COMMITTEE**

Edward W. Lowman, *Chairman*  
H. Worley Kendall  
Frank H. Krusen

■ \* ■  
**ARTICLE XII - COMMITTEES**

**SECTION 3. Duties of Standing Committees.**

(c) **THE NOMINATING COMMITTEE.** The Nominating Committee shall publish at least 30 days before the Annual Session, in the **ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION**, and shall present to the appropriate Executive Session of each Annual Session the names of members whom it recommends and nominates for election to offices or positions that are then vacant or will be vacant at the close of the Annual Session. However, any voting member of the Academy may nominate from the floor. Election shall be by majority vote of those present and voting. The report of the Nominating Committee, nominations from the floor, if any, and the election shall be a special order of business one hour after the scheduled time for the opening of the last Executive Session of the Annual Session.

*(Excerpt from By-Laws, American Academy of Physical Medicine and Rehabilitation as of August, 1960.)*



## *American Academy*

### OF PHYSICAL MEDICINE AND REHABILITATION

TWENTY-THIRD ASSEMBLY

## *Preliminary Program*

*This preliminary program will be revised by the Program Committee prior to the official opening of the assembly.*

### SCIENTIFIC SESSION

MONDAY, August 28—9:00 A.M.

#### ADDRESS OF WELCOME

Ray Piaskoski, M.D., President  
American Academy of Physical Medicine and Rehabilitation

**Panel Discussion: Private Practice of Physical Medicine and Rehabilitation.**

OSCAR O. SELKE, JR., M.D., Houston, Texas: *Moderator*

**The Physiatrist in Independent Private Practice.**

HERMAN L. RUDOLPH, M.D., Reading, Pennsylvania.

**The Physiatrist in a Private Hospital.**

HAROLD DINKEN, M.D., Denver.

**The Physiatrist and Economics.**

JOSEPH KOCZUR, M.D., Chicago.

**The Physiatrist and Legal Medicine.**

F. MANLEY BRIST, LL.B., St. Paul.

*Discussion of Topics Presented: Question and Answer Period.*



**SCIENTIFIC SESSION**

MONDAY, August 28—2:00 P.M.

**Panel Discussion: Brain Damage in Hemiplegia.**MILAND E. KNAPP, M.D., Minneapolis: *Moderator***Technics of Treatment for Aphasia.**

DANIEL BOONE, Ph.D., Cleveland.

**Brain Damage Testing.**

STEPHEN FINK, Ph.D., Cleveland.

**Results of Language Tests in Right and Left Hemiplegia.**

MILAND E. KNAPP, M.D., Minneapolis.

*Discussion of Topics Presented: Question and Answer Period.*

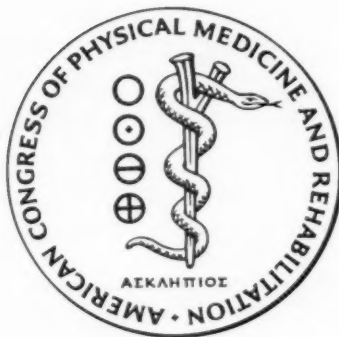
The scientific sessions of the 1961 assembly of the American Academy of Physical Medicine and Rehabilitation have been accepted for Category II credit for members of the American Academy of General Practice.





**AMERICAN CONGRESS OF  
PHYSICAL MEDICINE AND REHABILITATION**

*39th Annual Session*



**SHERATON-CLEVELAND HOTEL  
PUBLIC SQUARE  
CLEVELAND, OHIO  
AUGUST 27 - SEPTEMBER 1, 1961**



**Executive Office**

AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION  
30 North Michigan Avenue, Chicago 2, Illinois  
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*preliminary program and general information*

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# Members

## Standing Committees of the

### American Congress of Physical Medicine and Rehabilitation



1961

#### Awards and Prizes

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William J. Erdman, II  
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Harriet E. Gillette  
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Lewis A. Leavitt  
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Louis B. Newman  
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**AMERICAN CONGRESS OF PHYSICAL MEDICINE  
AND REHABILITATION**

**39th ANNUAL SESSION**

**Preliminary Program**

*This preliminary program (scientific papers, films and exhibits) is subject to revision by the Program Committee prior to the official opening of the conference.*

**TUESDAY, AUGUST 29**

**GENERAL SCIENTIFIC SESSION**

*Morning*

Presiding Officer — HERMAN J. BEARZY, Dayton, Ohio

Assisting Officer — LEO ROSENBERG, Dayton, Ohio

**Kinesiology of Selected Muscles Acting on the Wrist: Electromyographic Study.**

G. B. McFARLAND, JR., M.D.; URSULA L. KRUSEN, M.D., and HAL T. WEATHERSBY, PH.D., Departments of Physical Medicine and Anatomy, University of Texas Southwestern Medical School, Dallas, Texas.

The kinesiology of the wrist is being studied by means of multichannel electromyography and electrogoniometry. The electromyograph used is the eight-channel Gilson Electromyograph. One channel is used for each of the following muscles: the extensors carpi radialis longus and brevis; the extensor digitorum; the extensor carpi ulnaris; the flexor carpi ulnaris; the flexor digitorum superficialis, and the flexor carpi radialis. The eighth channel is used for an electrogoniometer designed by Francis Andries of Texas Instruments Inc., as a modification of the one described by Karpovich. The electrodes are monopolar intramuscular nylon coated wire 0.0011 inches in diameter as developed by Long, et al. The movements studied are flexion, extension, radial and ulnar deviation, with and without gravity elimination. The preliminary studies indicate the phasic interaction and the part that these muscles play in stabilization. Results will be displayed with charts, photographs and EMG tracings.

**Electromyographic Kinesiology of the Hand: Part III. Lumbrical and Flexor Profundus of the Long Finger.**

CHARLES LONG, II, M.D.; MARY ELEANOR BROWN, and GERDA FREEDHEIM, Highland View Hospital, Cleveland.

This is the third in a series of reports on an analysis of the extrinsic-intrinsic balance in the normal, moving hand. Previous reports have delineated the method used and the results obtained in studies of the extrinsic extensor and the interossei of the long finger. The same method, using simultaneous motion pictures and multi-channel ink-written electromyographs, was applied to the lumbrical and flexor digitorum profundus to the long finger. The results obtained in fourteen consecutive normals for the lumbrical and six for the profundus are reported. The lumbrical is noted to be a major participant only in those motions involving extension of the proximal and distal interphalangeal joints, or involving the "fixing" of these joints in extension. In this study certain specific differences between the behavior of the lumbrical and the interossei are demonstrated. Because of the close anatomic relationship between lumbrical and flexor profundus, activity of the flexor profundus is reported separately and in association with lumbrical function. Electromyographically the profundus behaves as would be expected, its activity coinciding with flexion at the DIP joint. In relation to the lumbrical, the profundus has a reciprocal, or antagonistic function, each muscle being silent during the action of the other. An hypothesis of the interaction of the muscle so far studied (extrinsic deep flexor and long extensor, intrinsic lumbrical and both interossei) in the long finger is presented.

**Diagnosis of Carpal Tunnel Syndrome.**

ERNEST W. JOHNSON, M.D., Associate Professor and Director, Division of Physical Medicine and Rehabilitation, Department of Medicine, Ohio State University; ROBERT WELLS, M.D., Senior Assistant Resident, Division of Physical Medicine and Rehabilitation, Department of Medicine, Ohio State University; Trainee, Office of Vocational Rehabilitation, and ROBERT DURAN, M.D., Instructor, Department of Surgery, Ohio State University, Columbus, Ohio.

Complaints of numb, tingling and painful hands are commonly thought of as arthritis. Pressure on the median nerve in the carpal tunnel from a variety of conditions is a frequent cause for these symptoms. Since section of the carpal ligament usually results in relief, it is extremely important to recognize this structural defect early. When the median nerve is stimulated supramaximally proximal to the wrist, the conduction delay to the opponens muscle is usually less than five milliseconds. In carpal tunnel syndrome, this delay is increased. A group of 20 patients with this syndrome is presented with delays ranging from 6-13 milliseconds. Clinical and radiographic findings are also discussed.

**Electrodiagnosis and Electromyography in Unusual Clinical Syndromes.**

HERMAN WING, M.D., Assistant Professor, Physical Medicine and Rehabilitation, Baylor University College of Medicine, and LEWIS A. LEAVITT, M.D., Chairman, Department of Physical Medicine and Rehabilitation, Baylor University College of Medicine, Houston, Texas.

This paper will discuss some electrodiagnostic findings of interest to physical medicine and rehabilitation which were seen in three unusual clinical syndromes. The authors will correlate the electrodiagnostic and electromyographic findings and pathology with slides. The presentation will include a patient with a glomus tumor of the right common peroneal nerve, a patient with fulminating dermatomyositis, and a third patient with chemical neuritis, originally diagnosed as having conversion hysteria.

**Motor Nerve Conduction Velocity in Premature Infants.**

DOMINGO CERRA, M.D., Medical Consultant, Bureau of Vocational Rehabilitation, State of Ohio and formerly Senior Assistant Resident, Division of Physical Medicine and Rehabilitation, Department of Medicine, Ohio State University, and formerly Trainee, Office of Vocational Rehabilitation, and ERNEST W. JOHNSON, M.D., Associate Professor and Director, Division of Physical Medicine and Rehabilitation, Department of Medicine, Ohio State University, Columbus, Ohio.

The conduction velocity was determined in the motor fibers of 17 peroneal nerves and 19 ulnar nerves of 11 premature infants of varying weights and gestational periods. The mean velocity in the ulnar nerve was 20.2 m/sec. and the peroneal nerve was 19.1 m/sec. Ulnar nerve conduction velocity in newborns average 28 m/sec. and in adults 55 m/sec. The conduction velocity in both nerves correlated significantly with the weight of the infant and thus presumably, the degree of immaturity. There was a positive but not statistically significant correlation between conduction velocity and the length of gestation. On two infants on whom repeated determinations were done, the conduction velocity rose from 16.6 m/sec. to 20.6 m/sec. in 2 weeks. This determination may be helpful in estimating the degree of prematurity.

**Clinical Study of Pain: Electromyographic Observations in Trauma and Control Subjects; Correlation with Plethysmographic and Skin Resistance Studies.**

MAX KARL NEWMAN, M.D., and MAURICE FLOCH, PH.D., Detroit Memorial Hospital and Sinai Hospital, Detroit.

Pain, as representative of emotional and nervous tension and stress, has not been subject to objective mensuration. In the field of trauma, muscle and tissue pain can only be determined indirectly. Hence, this study for the physiologic measurement of pain as represented by emotional tension can be observed by electronic and mechanical devices. Plethysmography demonstrates changes in peripheral blood volume, and represents pulse rate and blood vessel caliber. Action potentials in muscle vary in a predictable fashion with changes in tension indicating pain. Skin resistance represents action of the autonomic nervous system, and is measured by the

dermometer. Hence, in the triad of electronic devices, the plethysmograph, electromyograph and dermometer are of value in determining changes in emotional states representative of pain. In a group of 50 patients with acceleration-deceleration injuries, examination was carried out by means of these devices. Stimulation was produced by careful psychologically equated material and by voluntary contraction. When compared to a group of 50 normal patients, the physiologic responses are indicative of variations in emotional tensions representing pain. Further investigative procedures of this type will be of value in pain evaluation in neuromusculoskeletal trauma of acceleration-deceleration types of injuries.

#### **Analgesia in Electromyography.**

WILLIAM JOSEPH LaJOIE, M.D., Phoenix, Arizona.

The author has been disturbed for a number of years by the pain which is induced in the needling procedures during electromyographic examination. This is particularly distressing with children. At times adequate examination could not be made either in adults or children because of the element of pain. It was felt, therefore, that it was imperative to develop some technic in which analgesia could be produced without interfering with the patient's ability to cooperate or interfere with the electromyographic examination. The author tried several different medications until he found one which was the easiest to use clinically with the least undesirable side effects on the patient. A small group of patients with known pathology were tested both before and after the analgesia was given; maximum effort and electrical excitability were also tested. The author found that the analgesia in no way diminished the amplitude of voluntary contraction, where it existed, it did not interfere or alter pathological electromyographic tracings to any appreciable extent, nor appreciably reduce electrical excitability. The author has utilized this technic now in over 100 patients and is impressed with the extreme ease in which the EMG can now be conducted, making more thorough examination possible.

### **GENERAL SCIENTIFIC SESSION**

*Morning*

*August 29*

Presiding Officer — HARRIET E. GILLETTE, Cleveland

Assisting Officer — OSCAR O. SELKE, JR., Houston, Texas

#### **Medical Rehabilitation and the National Health Grants and Health Insurance Programs in Canada.**

BERTRAND PRIMEAU, M.D., Medical Consultant and Chief Medical Rehabilitation and Disability Advisory Service, Department of National Health and Welfare, Ottawa, Ont., Canada.

Physical restoration programs in Canada have been originally established and developed for the rehabilitation of disabled veterans and of handicapped laborers entitled to Provincial Workmen's Compensation Board Benefits. In the civilian field, voluntary undertakings have led the way to officially sponsored programs. A summary is presented of the resources locally available for medical restoration at the time when consideration was given to the establishment of a program of grants-in-aid in the field of public health. When the National Health Grants Program was instituted in 1948, it was clearly stated that projects could be submitted for financial assistance in the three main areas of prevention, treatment and rehabilitation under each one of the original grants. The repercussions observed during the first five years of the program in the development of medical rehabilitation facilities for patients suffering of specific disease entities and for crippled children are reviewed. In 1953, a specific Medical Rehabilitation Grant was introduced to fill the gaps left uncovered by the original health grants in the area of rehabilitation. What have been the results of the utilization of such assistance in the professional training of more numerous and more adequately qualified personnel, in the acquisition of necessary physical medicine equipment and supplies, in the establishment of new and extension of existing physical medicine and rehabilitation hospital departments and out-patient centers, in the more generalized availability of medical rehabilitation services for a greater number of handicapped Canadians, in the conduct of research studies in the field of medical rehabilitation or in other directly related fields? During the last two years, joint Federal-Provincial programs of hospital insurance and diagnostic services have been initiated successively in every one of the 10 Canadian provinces. Such immediate consequences of this new scheme are analyzed as its repercussions on the bed occupancy of the active treatment hospital, its stimulating effect on the

opening and extension of physical medicine and rehabilitation facilities both in and out of hospitals, its effects on the new or improved organization of chronic care and home care programs.

### **Principles of Organization for Care of the Severely Disabled.**

ROBERT R. JACKSON, M.D.; WILLIAM A. SPENCER, M.D.; CARLOS VALLBONA, M.D.; GUNYON M. HARRISON, M.D., and HEBBEL E. HOFF, M.D., Texas Institute for Rehabilitation and Research, Houston, Texas.

Over ten years' experience with management of patients who have severe disability has afforded the opportunity to establish certain guidelines useful in arranging the organization necessary to meet the needs of these severely disabled people. During this period, over 3,000 in-patients have been treated and an average of 5,000 out-patients served per year. These patients have had traumatic paraplegia and quadriplegia; amputations; severe poliomyelitis residuals (including nearly 600 respirator patients); severe rheumatoid arthritis; severe residuals of cerebrovascular accident, particularly persons with speech involvement, and various other conditions involving the neuromuscular and/or cardiorespiratory systems. This experience has been gained in a university-affiliated chronic disease hospital and research facility which grew from a regional poliomyelitis respiratory and rehabilitation center. It serves a wide geographic area. Among the guidelines that have proved useful in the management of severe disability are:

- 1) The program should be under full-time medical direction.
- 2) The patient care activities should be in the hands of full-time or part-time medical and paramedical staff. Around the problems of severe disability, treatment programing cannot be done effectively by consultation.
- 3) Teaching and research should be included as an integral part of the program. It is essential that if extension of the knowledge currently available is to be achieved that organized teaching programs must exist, but if these are to be of most value they must constantly be enhanced by the addition of new knowledge gained from research into the problems of the growing numbers of chronically ill people. Both laboratory and bedside research are required.
- 4) All paramedical participants must be encouraged to assume full professional status and its attendant responsibilities. The physician must retain responsibility for direction, but the problems presented by a severely disabled person surpass the capability of any one physician to cope with them. Rehabilitation of the severely disabled is a process that comes to grips with all aspects of the altered way of life that disability has forced upon the patient and the solution to the attendant problems requires the skills and contributions of a number of professional people.
- 5) Coordination of the treatment program by frequent informal contacts and by regularly scheduled case conferences is mandatory. Inclusion of the various community agencies and resources is rewarding.
- 6) An organized program of periodic readmission for re-evaluation is essential in maintenance of long-term productivity of the severely disabled. Such a program permits early detection and correction of medical, social, and psychological complications.
- 7) University affiliation is highly desirable not only for the teaching and research support, but also to provide contact and communication with colleagues in the basic sciences of a medical curriculum and in the physical sciences. It is from contact with students of the medical and paramedical specialties that future workers sorely needed in this field will be recruited.

### **A Medical Care Program for the Physically Disabled in a Modern Comprehensive Rehabilitation Center.**

LUCIEN LEWIS TRIGIANO, M.D., Medical Director, Pennsylvania Rehabilitation Center, Johnstown, Pennsylvania.

The purpose of this paper is to show the need for comprehensive medical care in an atmosphere where sometimes the physical disability overshadows the actual need for a program of this type. It has been the aim at the Pennsylvania Rehabilitation Center to give total medical care. Incorporated in the total medical care are the physical restoration programs along with adequate intercurrent and concurrent medical treatment of the physically disabled.



**Medical Aspects in a Sheltered Workshop.**

E. DAVID SHERMAN, M.D.; GUSTAVE GINGRAS, M.D., and EDWARD LEVINSON, M.D., Jewish Vocational Service, Montreal, Que., Canada.

The basic concept of integrating sheltered employment into the total process and organization of rehabilitation is enunciated. This requires integration with other agencies in the field of rehabilitation, particularly medical services and institutions; educational and vocational services, and social work agencies. This communication will attempt to outline the value and progress of the first year of the medical program that was instituted in this workshop through a Provincial-Federal Grant. The role of the medical team is described. Thirty-five clients were examined. Psychiatric and emotional disorders and cardiovascular disease comprised 77 per cent of the handicaps. Five clients, (14.2%) with psychiatric involvement including one epileptic were placed in industry. The integrated team work activities of the medical and vocational staffs have resulted in a form of dynamic rehabilitation. Medical and psychiatric supervision through the medium of ambulatory clinics, interviews and conferences has resulted in reducing absenteeism from the workshop. The workshop develops considerable motivation by work conditioning and stressing the changing of attitudes and the learning of skills. These factors are enhanced through regular medical supervision.

**Rehabilitation of Geriatric Patients in a General Hospital: Follow-Up Study of Forty-four Cases.**

FRANZ U. STEINBERG, M.D., Director, Division of Rehabilitation, and THELMA M. FROST, B.S., Social Worker, Division of Rehabilitation, Jewish Hospital of St. Louis, St. Louis.

The Jewish Hospital of St. Louis, a 500-bed general hospital, operates a 79-bed Division of Rehabilitation. A large proportion of these beds is devoted to the rehabilitation of geriatric patients. It is the goal of this service to return as many elderly patients as possible to an independent living in the community, outside of institutional walls. In order to test the effectiveness of this program, a follow-up study was conducted on 44 geriatric patients who, during the course of one year, were discharged to their homes. Among other criteria, the index of activities of daily living, described by the Benjamin Rose Hospital of Cleveland, was used as a measure of independence. Results indicated that geriatric patients retain the level of independence achieved in the rehabilitation program, unless struck by new illness. The effect of the type of illness, age and motivation on the success of the rehabilitation program is discussed. The organization of the program within the framework of the general hospital, its relation with a home care program, and methods of geriatric rehabilitation are described.

**Adaptation of Therapeutic Measures in Physical Medicine and Rehabilitation for Home Usage.**

LAWRENCE I. KAPLAN, M.D., and ANN P. KENT, M.D., Physical Medicine and Rehabilitation Service, Bellevue Hospital, New York City.

The authors are engaged respectively as Physiatric Consultant and Director of the Corona Rehabilitation Project, a research effort to explore in a proscribed area of New York City the most effective means for meeting rehabilitation needs of individuals with neuromuscular-skeletal disabilities. One objective is to set up practical standards for the home treatment of such patients. Experience has been acquired by a mobile home rehabilitation unit that permits sending registered physical therapists and public health nurses into the home to carry out treatments prescribed by the physiatrist. The project has attempted from the beginning to develop an orderly system of improvised rehabilitation technics that will utilize only such persons and materials as are available in the home. Although a variety of portable equipment can be purchased, it is bulky and virtually impossible to carry, even by car, from one home to the next. This article will describe a series of improvised measures to cover home application of heat; cold; resistive exercises; stretching, and passive range of motion. It will consist of general types of material available and methods of adapting them for specific uses and practical technics applicable to the more common disabilities. The authors intend to develop the content of this article subsequently as a manual of standards for use by visiting nurses, therapists and others required to treat patients at home.

**A "Common Sense" Approach for Effective Interdepartmental Relations.**

KARL H. HAASE, M.D.; MIGUEL J. RODRIGUEZ, M.D., and MURRAY LEVITTA, B.S., VA Center, Los Angeles.

There is always great need to be mindful of the importance which interdepartmental relations have on the growth and development of a physical medicine and rehabilitation service. This is a review of several years' experience in the development of a "common sense" type relation with other medical services and departments. Consistent use of basic human relations and methods of communications as implemented is discussed. This approach led to the development of an effective and well accepted service. It is concluded that the success or failure of a service depends directly on establishing good "common sense" type of interdepartmental relations.

**PLENARY SESSION**

*Afternoon*

*August 29*

Presiding Officer — DONALD A. COVALT, New York City

Assisting Officer — JOSEPH G. BENTON, Brooklyn

**OPENING OF THE THIRTY-NINTH  
ANNUAL SESSION****Presidential Address.**

DONALD A. COVALT, M.D., Institute of Physical Medicine and Rehabilitation, New York City.

**Eleventh John Stanley Coulter Memorial Lecture.**

DONALD L. ROSE, M.D., University of Kansas School of Medicine, Kansas City, Kansas.

**Dystonia Musculorum Deformans: Its Neurosurgical Treatment, Subsequent Rehabilitation, and Follow-Up Findings.**

IRVING S. COOPER, M.D., Director, Department of Neurosurgery; MANUEL RIKLAN, PH.D., Chief Psychological and Vocational Services; ZOFIA LASZ-EWSKI, M.D., Director, Physical Medicine and Rehabilitation, St. Barnabas Hospital for Chronic Diseases, New York City, and ANGELES BADELL, M.D., Research Associate, Pediatric Division, Institute of Physical Medicine and Rehabilitation, New York City.

During the past six years, 46 individuals with the diagnosis of dystonia musculorum deformans underwent chemothalamectomy and/or chemopallidectomy. The series consisted of both children and adults with a median age of 16.5 years, demonstrating a wide range of dystonic involvement and disability. In each instance, neurologic, psychologic and psychiatric examinations were carried out. Subsequent to surgery, each patient underwent an intensive rehabilitation program ranging from two to five weeks, emphasizing physical therapy and muscle re-education, as well as prevocational and vocational evaluation. Through periodic objective evaluations and/or follow-up questionnaires, a large majority of the patients have been followed up to six years subsequent to surgery. On the basis of a recently conducted follow-up investigation on patients evaluated, a mean of one and a half years subsequent to surgery (range: six months to six years), over 80 per cent of the group demonstrated significant symptomatic improvement. Moreover, a large majority experienced improvement in functional activities. In some instances, patients who were helpless and completely incapacitated prior to surgery have been able to return essentially to normal function.

**Electromyographic Control of Neurologic Examination: Some Clinical Implications.**

CARLO SERRA, M.D., Neurophysiological Department, Centro Traumatologico Ortopedico, Naples, Italy.

The main diagnostic and physiopathologic purposes of modern EMG examinations are

discussed. EMG investigations, mostly the modern stimulo-detection technics and evoked EMG, allow a careful control of clinical neurologic findings, especially of osteotendinous and cutaneous reflexes; spasticity conditions; conduction velocity of nerve trunks; excitatory state of spinal motoneurons; neuromuscular transmission, and excitatory state of motor end plate. In our department EMG examinations are systematically employed for studying the following clinical problems:

- a) pre- and post-operative control of traumatic lesions of peripheral nerves
- b) precise definition of the level of compression syndromes
- c) systemic evaluation of scoliotic and lumbolordotic spine
- d) precocious evaluation of poliomyelitic sequelae
- e) neuromuscular involvement of bone malformations
- f) pre- and post-operative study of transplanted muscles
- g) systemic control of clinical neurologic findings by skull and medullary injuries
- h) systemic control and final evaluation of clinical effects obtained.

#### **Upper Extremity Amputee Rehabilitation: A 10 Year Study.**

ARTHUR L. WATKINS, M.D., Department of Physical Medicine, Massachusetts General Hospital, Boston.

A study of 10 years experience in the rehabilitation of upper extremity amputees including prosthetic service reveals that approximately 150 individuals were seen in our out-patient rehabilitation clinic. This included 19 patients under 10 years of age usually with congenital amputations, the remainder were between 10 and 60 years of age, the males outnumbered the females five to one. The most common cause of amputation in this group was trauma. All variety of amputation sites were encountered with three bilateral cases. Information concerning terminal devices, the use of prostheses in work and in the home is included. Experience in prosthetic training problems and adjustment to the use of the limb psychologically is discussed. The findings of a questionnaire end-result study are included.

## **WEDNESDAY, AUGUST 30**

### **GENERAL SCIENTIFIC SESSION**

*Morning*

*August 30*

Presiding Officer — FRANCES BAKER, San Mateo, California

Assisting Officer — WALTER J. TREANOR, San Francisco

#### **Panel Discussion: Speech and Hearing—Physical Medicine and Rehabilitation.**

The purpose of this panel is to familiarize physiatrists and other physicians who provide rehabilitation care with the nature of the speech and hearing profession. It will attempt to clarify the educational requirements and training in the field of speech and hearing, including certification. It will attempt to delineate the responsibilities of the speech and hearing specialist and the physiatrist relative to the patient.

**Jerome S. Tobis, M.D., Moderator:** Professor and Chairman, Department of Physical Medicine and Rehabilitation, New York Medical College, New York City.

**Kenneth O. Johnson, Ph.D.,** Executive Secretary, American Speech and Hearing Association, Washington, D.C.

**Frederic J. Kottke, M.D.,** Professor and Chairman, Department of Physical Medicine and Rehabilitation, University of Minnesota Medical School, Minneapolis.

**Herold Lillywhite, Ph.D.,** Department of Pediatrics and Director of Speech and Hearing Division, University of Oregon Medical School, Portland, Oregon.

**Rehabilitation of Patients with Multiple Congenital Contractures (Arthrogryposis).**

CHESTER A. SWINYARD, M.D., and CONSTANTINE L. JEANNOPOLUS, M.D., Children's Division, Institute of Physical Medicine and Rehabilitation and New York University Medical Center, New York City.

This uncommon syndrome is characterized by variable combinations of congenital flexion and/or extension contracture of the extremities. The etiology is unknown. There is controversy whether the primary site of the pathological process is in the connective tissue, the muscle tissue or the nervous system. Experience with 50 patients with this condition and the nature of the syndrome in terms of incidence, classification, hereditary considerations, electromyographic and pathological findings, and general rehabilitation management of the contractures will be discussed.

**Rehabilitation of the Burned Hand.**

JoANNE K. GRONLEY, 1st Lt., AMSC, Staff Physical Therapist; MARY H. YEAKEL, 1st Lt., AMSC, Staff Occupational Therapist, and ARTHUR E. GRANT, Major, MC, Chief, Physical Medicine Service, Brooke General Hospital, Brooke Army Medical Center, Fort Sam Houston, Texas.

The hand is involved in a surprisingly high percentage of thermal injuries and this presents a problem in both civilian and military medicine. Approximately 110 severely burned patients are admitted each year to the U. S. Army Surgical Research Unit at Fort Sam Houston, Texas. Of this number, 75 per cent have burns involving the hands. Eighty per cent of these patients have burns of both hands, varying from superficial to deep second degree, full thickness skin destruction, or destruction of tendon and bone. The contractures, deformity and functional impairment caused by the thermal insult pose a problem of tremendous magnitude. The purpose of this paper is to present the methods currently used in the treatment of such burns at this installation with primary emphasis on the role of physical medicine and rehabilitation in the treatment program. Specific technics in physical and occupational therapy are presented in relation to total patient care. The use and construction of a newly developed fiberglass positioning device for use during the acute, post-grafting and convalescent phases will be included.

**Peripheral Neuropathy: Diagnosis and Management on a General Hospital, Rehabilitation Service.**

BORIS J. PAUL, M.D., and LEONARD D. POLICOFF, M.D., Albany Medical College of Union University, Albany, N.Y.

Peripheral neuropathy is one of the more frequent disease entities referred for diagnosis and treatment to the rehabilitation service of a general hospital. A variety of technics available to the physiatrist are of significant value in the diagnosis, prognosis and management of this group of disorders. It is the purpose of this paper to review the use of these diagnostic tools and the prognostic conclusions to be drawn from them and to attempt to formalize a management program for these disorders based upon experiences in a large general hospital physical medicine and rehabilitation service over a five-year period.

**GENERAL SCIENTIFIC SESSION**

*Morning*

*August 30*

Presiding Officer — SAMUEL S. SVERDLIK, New York City

Assisting Officer — NILA KIRKPATRICK COVALT, Winter Park, Fla.

**Quantitative Values for Normal and Fair Muscle Systems in Childhood.**

WILLIS C. BEASLEY, PH.D., Director, Kinesiology Laboratory, Elizabeth Kenny Institute, Minneapolis; Director, Biophysics Research Laboratory, Bethesda, Md.

This paper describes original methods employed in research extending over a 14-year period, and presents results obtained from deriving quantitative values of Normal and Fair

muscle systems. The statistical analysis presented now is based upon measurements of the forces for 38 principal muscle systems of 600 children in the age range from 10 to 12 years inclusive. The essential procedure involves measuring the resultant muscular force required to raise a body segment against gravity in the conventional positioning methods employed clinically (Fair criterion); measuring the maximum effective force for the same actions among normal subjects (Normal criterion), and computing the percentage ratio of Fair/Normal forces. This percentage ratio yields a quantitative reference standard for the percentage level of Fair muscle systems relative to expected Normal and provides a realistic evaluation clinically for the proportionate loss of functional capacity represented by Fair muscle systems. The results show that actually Fair has a widely scattered position on the quantitative percentage scale: for approximately one-third of the 38 muscular actions, Fair is at 2 per cent or less of Normal; another one-third ranges between 3 and 10 per cent of Normal; only three actions are greater than 30 per cent, and none attains the level of 50 per cent. The customary procedure of assigning an arbitrary 50 per cent value to Fair muscle systems is grossly erroneous, both in clinical and epidemiological application. The standardized values provided from this research can be applied directly to help rectify some of the extremely large systematic errors inherent in current practices of muscle scoring.

#### **Effect of Interval Between Bouts of Stimulation of Denervated Rat Muscle.**

G. KEITH STILLWELL, M.D., Consultant, Section of Physical Medicine and Rehabilitation, Mayo Clinic; Assistant Professor of Physical Medicine and Rehabilitation, Mayo Foundation, and KHALIL G. WAKIM, M.D., Professor of Physiology, Mayo Foundation, Rochester, Minn.

Significant retardation of atrophy of denervated skeletal muscle in the rat by electric stimulation requires several bouts of stimulation each day. Kosman, Osborne and Ivy in 1947 suggested that in a clinical situation these several bouts of stimulation might all be done in the same hour while the patient is in the department of physical therapy. In the present study, the sciatic nerve of one side was sectioned in rats and the work output and weight of the gastrocnemius, plantaris and anterior tibial muscles were observed. Stimulation was given over a period of one minute by means of a constant-current stimulator with a frequency of stimuli of 16 impulses per second. Those muscles stimulated for one minute four times in one hour each day showed a better work output and endurance than did those stimulated for one minute four times in each day; the work output and endurance of the latter muscles were not much different from those of the denervated unstimulated controls. The differences in the weights of the denervated muscles in the different groups were small.

#### **Recent Advances and Problems of Microwave Therapy.**

JUSTUS F. LEHMANN, M.D.; GEORGE D. BRUNNER, B.S., and JO ANN McMILLAN, B.S., Department of Physical Medicine and Rehabilitation, University of Washington School of Medicine, Seattle.

The advantages and disadvantages of the therapeutic use of microwaves in the frequency of 2450 and 900 megacycles are discussed. This is done on the basis of the distribution of relative heating within simple and more complex specimen. The resulting temperature distributions are studied. Also an effort is made to assess the influence of focusing devices such as reflectors on the energy distribution within the specimen, and special attention is given to the problems of reflection at the interface between subcutaneous fat and muscle and at the interface musculature bone. This problem is studied in relation to the frequency of the microwave radiation applied and to the thickness of the various tissue layers. In conclusion, results of preliminary investigation suggest strongly that a microwave frequency of 900 megacycles would have several advantages over the use of the customary 2450 megacycle frequency.

**GENERAL SCIENTIFIC SESSION***Afternoon**August 30*

Presiding Officer — NADENE E. COYNE, New York City

Assisting Officer — HILDA B. CASE, Cleveland

**Increment Variation in Different Muscles with Brief Maximal Exercise (IBM).**

LAYTON R. SUTTON, M.D., and EDWARD M. KRUSEN, M.D., Department of Physical Medicine and Rehabilitation, Baylor University Medical Center, Dallas, Texas.

The strengthening of muscles through isotonic brief maximal (IBM) contraction has been found effective by other investigators. This study compares the use of  $\frac{3}{4}$  pound and  $1\frac{1}{4}$  pound increments as the daily weight increase for various muscles, using a single repetition of weight lifted and held for five seconds. Normal subjects and patients with specific pathology are evaluated.

**Gait Accelerography.**

W. T. LIBERSON, M.D.; HAROLD J. HOLMQUEST, B.S., and ALBERT HALLS, M.S., VA Hospital, Hines, Ill.

Use of accelerometers for the recording of normal and pathological characteristics of gaits was proposed by one of us (WTL) in 1936. Lately, decisive progress has been accomplished. This method involves the application of strain gauge accelerometers to the trunk (in the vertical, horizontal and lateral direction), and to the thighs and lower extremities (dual units wired in opposition in order to record angular accelerations only). This method has an advantage over the force plates as it permits one to characterize both stance and swing phases. Moreover, the equipment is cheaper and does not necessitate any construction. Conventional polygraphs with ink writers are used. About 10 normal individuals, 10 hemiplegics and 10 A/K amputees were examined. Characteristic changes were found in hemiplegics and amputees. They will be discussed in detail.

**Five-Step Test of Cardiac Performance During Occupational Activity.**

FREDERIC J. KOTTKE, M.D.; W. G. KUBICEK, PH.D.; MILDRED E. OLSON, B.S., and RUTH H. HASTINGS, B.S., OTR, Department of Physical Medicine and Rehabilitation, University of Minnesota, Minneapolis.

A five-step test of cardiac performance under the supine basal condition, sitting at rest, at 125 per cent, 200 per cent and 300 per cent of basal was developed. The cardiac responses to these tests were studied on six normal young men. Parameters of cardiac stress including oxygen consumption, respiratory minute volume, pulse rate, arterial venous oxygen difference, systolic, diastolic and effective arterial blood pressure, cardiac output, electrocardiogram, cardiac work per minute and ventricular stroke column were measured and calculated. The test provides five standard levels of activity during which parameters of cardiac work can be measured and compared for normal subjects, or patients with myocardial disease. The levels of the test cover the energy range within which most vocational activities are performed and provide a basis for test of cardiac competence to return to work.

**Cardiac Findings in Muscular Dystrophy Patients.**

LEON GREENSPAN, M.D., Assistant Director, Children's Division, Institute of Physical Medicine and Rehabilitation; Assistant Clinical Professor, Physical Medicine and Rehabilitation, New York University Medical Center, and MENARD GERTLER, M.D., Director of Research, Institute of Physical Medicine and Rehabilitation; Associate Professor, Physical Medicine and Rehabilitation, New York University Medical Center, New York City.

The purpose of this paper is to present the electrocardiograph findings in muscular dystrophy patients varying in age from the first decade through the fifth decade of life. These patients have been diagnosed as having either one of the following types of muscular dystrophy: childhood progressive, limb-girdle, facio-scapulo-humeral and myotonic. Electrocardiographs have



been done on these patients and correlated with their functional status on the basis of the eight criteria which have been described by Doctors Swinyard, Deaver and Greenspan.

#### **Effects of Training and Athletic Participation on Physical Performance of High School Boys.**

JOSEPH C. HONET, M.D., Fellow in Physical Medicine and Rehabilitation, Mayo Foundation; CLIFTON E. BAKER, M.D., Fellow in Orthopedics, Mayo Foundation; EARL C. ELKINS, M.D., Section of Physical Medicine and Rehabilitation, Mayo Clinic and Mayo Foundation, and WARD S. FOWLER, M.D., Section of Physiology, Mayo Clinic and Mayo Foundation, Rochester, Minn.

The effect of athletic participation, with or without progressive summer preconditioning exercise, on the physical performance of 33 high school boys was studied throughout one school year. Performance was determined as work output during maximal exercise for one minute on a bicycle ergometer; pulse rate was measured by cardiometer. All subjects played interscholastic football. During preconditioning (four weeks) and the football season (10 weeks), the preconditioned group (18 boys) achieved and maintained an increased work output, and they demonstrated a decreased pulse rate (two-minute postexercise pulse rate per unit work). Work output of the nonconditioned group (15 boys) decreased during the early part of the football season and increased thereafter. Additional increase of work output was achieved by both groups during succeeding periods of participation in winter and spring sports. Work output of nonathletic control subjects did not increase during the year. Progressive conditioning exercise increased physical performance of boys participating in athletics.

#### **Some Considerations About the Appraisal of Human Physical Fitness.**

DAVID CARDUS, M.D., Texas Institute for Rehabilitation and Research, Houston, Texas.

A review of the investigations done up to date shows that estimations of human physical fitness inescapably refer to a specific task. It is then apparent that if comparable measurements have to be made in different individuals this task has to be defined and the methods utilized in obtaining quantitative data have to be standardized. Controlled muscular work requiring a minimum of skill permits the description of the concepts of physical condition and physical working capacity of an individual. Physiologic measurements to objectivate the expression of these concepts must afford criteria for medical appraisal of the physical condition of acutely or chronically disabled persons in the course of a disease and in the process of rehabilitation. Such measurements would also permit matching human working capacity with industrial or military demands and they would prepare us for the probable challenge of man having to face the problem of his own adaptation to possible new environments. It is also of great interest that differences in biological endowment and the effects of industrial automation, training and recreation can be determined. A discussion concerning the concepts; the selection, and difficulties of the methods to be used seems pertinent at this stage of the problem.

### **GENERAL SCIENTIFIC SESSION**

*Afternoon*

*August 30*

Presiding Officer — ROBERT W. BOYLE, Milwaukee

Assisting Officer — MURRAY FREED, Boston

#### **Effect of Physical Modalities Upon RA I 131 Iontophoresis.**

HARRY T. ZANKEL, M.D., Chief, Physical Medicine and Rehabilitation, VA Hospital, and HENRY KAMIN, PH.D., Assistant Professor of Biophysicchemistry, Duke University School of Medicine, Durham, N.C.

In a previous report it was shown that RA I 131 can be driven into the skin, and through the skin into the circulation. The per cent absorption by the skin and by the circulation measured in 24 hour urine was described. The present report deals with the effects of various physical modalities upon iontophoresis using radioactive iodine (I 131). Modalities used include short wave and microwave diathermy, cold, ultrasonic vibration, stimulation, and histamine iontophoresis to area treated, and others. Results will be shown and the clinical application will be suggested.

### **Study of the Conduction Delay in the Median Nerve in Patients with Rheumatoid Arthritis.**

ROBERT WELLS, M.D., Senior Assistant Resident, Division of Physical Medicine and Rehabilitation, Department of Medicine, Ohio State University; Trainee, Office of Vocational Rehabilitation, and ERNEST W. JOHNSON, M.D., Associate Professor and Director, Division of Physical Medicine and Rehabilitation, Department of Medicine, Ohio State University, Columbus, Ohio.

Authorities have suggested that compression of the median nerve in the carpal tunnel was a frequent occurrence with rheumatoid arthritis patients with involvement of the wrist. Although we have been searching our patients for this syndrome, we have been disappointed. To test the hypothesis that rheumatoid involvement of the wrist did not alter along the median nerve at the carpal ligament this study was undertaken. Twenty-five patients with rheumatoid arthritis and clinical involvement of the wrist were investigated by the ninhydrin sweat test of the digits and also the determination of the conduction delay in the median nerve at the wrist. There was remarkably little difference in the conduction delay between these patients and patients free of rheumatoid arthritis of the same age group. Correlation between the conduction delay and the sed rate, age and sex was also unrewarding. It was concluded that rheumatoid arthritis is not a common cause of carpal tunnel syndrome in spite of obvious involvement of the wrist.

### **The Painful Shoulder in Hemiplegia.**

MIECZYSLAW PESZCZYNSKI, M.D., and THOMAS E. RARDIN, JR., B.A., Highland View Hospital, Cleveland.

The incidence of a painful shoulder in 100 consecutive cases of hemiplegia is presented. Statistical data, including the correlation with subluxation of the hemiplegic shoulder and with central involvement of the autonomic system are discussed. Characteristic diagnostic features, especially localization of the pain in the shoulder; possible etiologic factors; probable influence on the character of a central pain in hemiplegia; probable influence on the patients' activities of daily living (ADL) performances; and treatment are presented.

### **Study of 480 Consecutive Cases of Cerebrovascular Accident.**

ROBERT W. BOYLE, M.D., Professor, Department of Physical Medicine, Marquette University School of Medicine; Director, Department of Physical Medicine, Milwaukee County Hospital, and PETER D. SCALZITTI, Senior Medical Student, Marquette University School of Medicine, Milwaukee.

This report contains the study of 480 cases of cerebrovascular accident referred to the Department of Physical Medicine, Milwaukee County Hospital, from April, 1956 through December, 1958. The study was undertaken with three objectives in mind: 1) to determine the effectiveness of physical therapy procedures on the recovery of a patient who had suffered a cerebrovascular accident; 2) to determine which patients had been helped in their rehabilitation by physical therapy with the view in mind of evaluating which patients would benefit from physical therapy and which patients would not, and, 3) to try to establish a relationship between the duration of time which had elapsed between the onset of the cerebrovascular accident and the beginning of physical therapy and the capacity of the patient to be rehabilitated. The evaluation of the data is not as conclusive as some of the past literature might lead us to believe. The main reason for some of these discrepancies may lie in the fact that over two-thirds of the patients reported were over 60 years old. Probably the most dismaying fact was that more than two-thirds of the patients had expired between the time of referral and the follow-up time.

### **Psychologic Studies in Hemiplegia.**

EDWARD J. LORENZE, M.D., Medical Director, and RALPH CANCRO, Chief, Psychologic and Vocational Service, The Burke Foundation Rehabilitation Center, White Plains, N.Y.

In an earlier study of the 119 hemiplegics, 35 were studied for severity of visual perceptual disturbances. Standardized tests of Intelligence in conjunction with specific subtests of the Goldstein Scheerer Test of Abstract Behavior were used to determine the presence and severity of the visual perceptual problem. The incidence was high; only three of the 35 patients showed no defects in this respect. The most striking findings in the seven cases of severe visual perceptual

disturbance were that these patients failed particularly in activities of daily living, and the hemiplegia was on the left side. Since the sample of 35 patients was so small, no specific conclusions could be drawn statistically as to the relationship between visual perceptual problems and the functional status of the patient in terms of activities of daily living and ambulation. The present study is an extension of the previous one by detailed testing of 50 additional patients with correlation of the psychological test findings in terms of visual perception correlated to success in ambulation and activities of daily living.

#### **Effect of Splinting on Reflex Inhibition and Sensorimeter Stimulation in Spasticity.**

NATHAN KAPLAN, M.D., Fellow, Physical Medicine and Rehabilitation,  
Columbia-Presbyterian Medical Center, New York City.

Bobath's and Rood's technics are used frequently in cerebral palsy and hemiplegia. This study is an attempt to determine if prolonged therapy through use of a dorsal splint will inhibit or diminish hyperreflexia or stretch reflex and at the same time increase muscle power by sensorimotor stimulation. Preliminary trials and attempts with different materials to find the most appropriate splint, and description of present splint used are reported. Ten patients with onset of hemiplegia from nine months to 30 years ago were involved in the study. Preliminary electromyography to record spasticity and muscle strength in involved upper extremity, and occupational therapy evaluation of hand and wrist function were made before splint application. Repeated evaluations, both clinically and objectively, were made during the study. Apparent improvement in muscle strength and function with decrease in stretch reflex and spasticity were noted through use of a properly applied dorsal splint in upper extremity hemiplegia.

## **THURSDAY, AUGUST 31**

### **GENERAL SCIENTIFIC SESSION**

#### *Morning*

Presiding Officer — ROBERT C. DARLING, New York City

Assisting Officer — CHESTER A. SWINYARD, New York City

#### **Panel Discussion: Current Trends in Amputation Prosthetic Management.**

This panel will be concerned primarily with current trends in amputee prosthetic management. There will be detailed discussions and demonstrations of the fabrication, fitting and training of the Patellar Tendon Bearing Below-Knee Prosthesis and the Canadian Hip-Disarticulation and Canadian Symes type Prostheses. Research considerations, in particular, the single control prosthesis for above-elbow level amputations will also be presented. In order to acquaint the physiatrist with overall amputee considerations, presentations of the roles of the American Orthotic and Prosthetic Association and the American Board for Certification in Prosthetics and Orthotics will be made. A description of the services made available by the Committee on Prosthetic Education and Information will be made. Methods of presentation will include films and slides as well as demonstrations.

**Frederick E. Vultee, M.D., Moderator:** Professor and Chairman, Department of Physical Medicine and Rehabilitation, Medical College of Virginia, School of Medicine, Richmond, Va.

*The Role of the Committee on Prosthetic Education and Information, National Academy of Sciences—National Research Council.*

**H. Blair Hanger, C.P.,** Associate Director of Prosthetic Education, Northwestern University Medical School, Chicago.

*The Canadian Hip-Disarticulation and the Canadian Symes Prostheses.  
Research Considerations in Prosthetic Management.*

**Colin A. McLaurin, B.A.S.**, Director, Prosthetic Research Center, Northwestern University Medical School, Chicago.

*Relationship of the American Orthotics and Prosthetics Association to the Physician.*

**J. Warren Perry, Ph.D.**, Assistant Chief, Division of Training, Office of Vocational Rehabilitation, Washington, D.C.

*Traineeships in Prosthetic Education.*

**Lester A. Smith**, Executive Director, American Orthotics and Prosthetics Association, Washington, D.C.

*The American Board for Certification in Orthotics and Prosthetics.*

**LeRoy W. Nattress, Jr.**, Executive Director, American Board for Certification in Orthotics and Prosthetics, Washington, D.C.

*Summary and Conclusions: Question and Answer Period.*

## GENERAL SCIENTIFIC SESSION

Afternoon

August 31

Presiding Officer — O. L. HUDDLESTON, Santa Monica, California

Assisting Officer — EDWARD M. KRUSEN, Dallas, Texas

### **Experience with the Patellar Tendon-Bearing Total Contact Socket, Below-Knee Prosthesis.**

LESTER E. WOLCOTT, M.D., Senior Clinical Instructor, National Foundation Fellow, and GEORGE H. KOEPKE, M.D., Associate Professor of Physical Medicine and Rehabilitation, Department of Physical Medicine and Rehabilitation, University of Michigan Medical Center, Ann Arbor, Mich.

Evaluation of 50 below-knee amputees for whom this prosthesis has been prescribed during the past 18 months reveals uniformly satisfactory results. Included in the study were patients from diverse socioeconomic background, of all age groups, their amputations were for various conditions, and their stumps were of widely varying length and pathology. There were some bilateral amputees and many had complicating orthopedic and neuromuscular disorders. About one-third had been previously fitted with wooden sockets having corsets and side joints. To provide comfort and good performance in this heterogeneous group, it has been necessary to use a prosthesis with wide flexibility in alignment, suspension, and stability. With appropriate fit and alignment, the patellar tendon-bearing, total contact socket, below-knee prosthesis has met the specific needs of the patient. With few exceptions, side joints and corset have been unnecessary. Maintenance has been minimal, and patient acceptance has been excellent.

### **Conservative Management of Trophic Skin Changes in Lower Extremity Amputees.**

LEWIS A. LEAVITT, M.D., Chairman, Department of Physical Medicine; Professor, Physical Medicine and Rehabilitation; WILLIAM G. RYAN, M.D., Acting Chief, Physical Medicine and Rehabilitation Service, VA Hospital; Assistant Professor, Physical Medicine and Rehabilitation, Baylor University College of Medicine, and A. L. MUILENBERG, Certified Prosthetist, Houston, Texas.

This paper will discuss those characteristic trophic skin changes and pain syndromes frequently seen in lower extremity amputees who have been wearing prostheses for many years. Conservative management of such amputees, approached from symptomatic, etiologic and functional aspects, will be outlined. The paper will illustrate, through patient histories and visual aids, how many such amputees, having trophic skin changes thought to be irreversible and necessitating surgical intervention and revision, frequently may be properly managed through physical medicine and prosthetic programs.

**Measurement of Joint Disability.**

JOSEPH BERKELEY, M.B., Ch.B., M.D. (Glasgow) D.P.H., Medical Director, Red Cross Physical Medicine and Cerebral Palsy Centre; Chief, Physical Medicine Department, Metropolitan Hospital, Windsor, Ont., Canada.

There is need to improve methods of describing joint disability. While the terminology is adequate for describing the primary cause, e.g., in a neuromuscular, arthritic, or traumatic category, and for describing radiological changes, the usual descriptions of secondary changes in soft tissue and muscle lack uniformity and clarity. Various methods, each different from the other, are in common use to record limitation of joint motion. Frequently important factors, such as site of muscle weakness, soft tissue adherence or pain, are omitted from the record or are charted separately, so that the reader has difficulty in visualizing the disability. This is especially noteworthy in disabilities of the hand. This lack of clear statement of the nature and extent of weakness and stiffness hampers the work of the physiatrist—in communicating with therapists, in evaluating response to therapy, and in classifying joint disability so as to compare similar groups of cases. In this paper, a method is presented of describing the nature and extent of joint disability in a condensed compact form. Both active and passive movements are recorded after the manner of Sterling Bunnell, with emphasis on the lack of movement rather than the range.

**Changing Shape of the Cervical Articular Masses.**

HERBERT A. SCHOENING, M.D., Consultant in Physical Medicine and Rehabilitation, Kenny Rehabilitation Institute; Clinical Instructor, Department of Physical Medicine and Rehabilitation, University of Minnesota School of Medicine, Minneapolis.

The present study shows that the symmetry of the cervical articular masses in young persons is frequently lost in older individuals. The cervical spines of 28 elderly cadavers, the great preponderance of whom were men, were cleaned of all tissue except the annulus fibrosus which held the vertebrae together. Antero-posterior radiographs of the cervical spines were made with the x-rays directed parallel to the joint surfaces of the articular masses and the degree of inclination of the superior and inferior surfaces of the 4th, 5th and 6th anterior masses in the frontal plane were measured. The same radiographic technic was used to measure the inclination of the joint surfaces of the 4th, 5th and 6th cervical articular masses in 13 young women. The range of the absolute differences between the inclinations of each articular mass and its counterpart in every neck is a measure of symmetry, with a wide range indicating asymmetry and a narrow range symmetry. The mean range for the young females was significantly less than that for the cadavers and furthermore the variance of the range for the females was also significantly less than the cadavers. The effects of trauma and/or degeneration of the intervertebral discs as causative factors in the development of this asymmetry are discussed.

**Effectiveness of Cervical Traction in Treatment of Neck Problems: Evaluation of Various Methods.**

JAMES W. CALDWELL, M.D., and EDWARD M. KRUSEN, M.D., Department of Physical Medicine and Rehabilitation, Baylor University Medical Center, Dallas, Texas.

This study compares different methods of traction used in the treatment of neck problems. Heat, massage, and exercises were held constant and the type of traction was varied. Types studied were bed traction; modified Hanflig's technic; motorized intermittent traction, and no traction. Results are discussed, including effect of certain medications.

**Rationale of Manipulation of a Joint.**

DR. RONALD C. BARBOR, London, England.

There is more difference of opinion over manipulation than over any other physical treatment. Manipulation is a word used to mean passive movement, forced movement, mobilization or stretching. Manipulation under anesthesia, as carried out by orthopedic surgeons, is reputable, but if carried out on a conscious patient it is disreputable in the eyes of the medical profession, because this is the method used by osteopaths and chiropractors. There is a lack of teaching in this subject to the medical student, since the elder statesman of medicine has not had sufficient experience in such a modern physical treatment. Manipulation of the spinal column should, in my opinion, become an every-day treatment. It is simple to learn and

to carry out. The difficulty is in the exact diagnosis and the exclusion of all unsuitable cases. Detailed examination of the joint is essential and the uncertain role of x-rays in diagnosis requires recognition. The three main uses of manipulation are to stretch out a contracture; to break an adhesion, and to reduce internal derangement. The general orthopedic uses, such as reducing a dislocation or a fracture under anesthesia are not discussed. The diagnostic pattern of suitable lesions is explained. The problem set by the lesion and the intention of the manipulation are described, and how these considerations influence technique. Finally, the advantages and disadvantages of anesthesia are discussed and the use of traction during manipulation and alone are dealt with in relation to the lumbar spine and the cervico-thoracic spinal joints. The question arises, who is the correct person to carry out this type of treatment—doctor or physical therapist?

## GENERAL SCIENTIFIC SESSION

*Afternoon*

*August 31*

Presiding Officer — THOMAS F. HINES, Wallingford, Connecticut

Assisting Officer — KENNETH C. ARCHIBALD, New York City

### **Methodology and Initial Findings in a Follow-Up Study of Spinal Cord Dysfunction.**

HOWARD A. RUSK, M.D.; BRUCE B. GRYNBAUM, M.D.; LAWRENCE I. KAPLAN, M.D., and KATHERINE LLOYD, M.D., Department of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, New York City.

For the past year, the Bellevue Hospital Department of Physical Medicine and Rehabilitation has been engaged in a comprehensive follow-up study of the paraplegics and quadriplegics previously serviced on its wards over the last decade. The potential study load numbers approximately 400 patients. The study seeks to evaluate those factors involved in the success or failure of the rehabilitation training which these patients were originally given at Bellevue Hospital. The objective is to develop more adequate criteria for prognosis, and greater realism in program planning. Evaluations are being made in: General Medical; G-U Status; Plastic Surgery; ADL; Orthotic and Self-Help Devices; Social Situation as seen by Patient, and by Collateral Informants; Sexual Adjustment; Indications of Fertility—Based on Ovulation in Female Paraplegics; Vocational History, and Psychological Make-up. Each area is being carefully individualized by specific studies that comprise open-end interviews, questionnaires, physical and other appropriate examinations. A separate aspect of the study consists of an on-going metabolic investigation that includes the following tests: P.B.I.; Serum Cholesterol; Glucose Tolerance; Urinary, Blood Keto and Hydroxy Steroids; Water Tolerance; Electrophoresis of Blood Proteins; B.S.P.; Creatinine; Alkaline Phosphatase; Thymol Turbidity; B.U.N.; C.V.C.; Urine Analysis. This will be the first of an anticipated series of papers to evaluate progressive findings; this paper will cover not only results from processing the first groups of study patients but also will elaborate in detail study methods utilized to date.

### **Control of Orthostatic Hypotension in Quadriplegic Patients with the Use of a Pressure Suit.**

CARLOS VALLBONA, M.D.; WILLIAM A. SPENCER, M.D.; J. W. DALE, and T. O. TOWNSEND, Texas Institute for Rehabilitation and Research, Houston, Texas.

The purpose of this investigation was to study if uniform pressure on the extremities and abdomen of quadriplegic individuals could control efficiently orthostatic hypotension. The heart rate and the systolic and diastolic blood pressures were measured in the supine position in five patients with traumatic paraplegia and in eight patients with traumatic quadriplegia. The ages of these patients ranged from 16 to 59 years (average 30.5). The duration of their illness ranged from three months to four years (average 12.6 months). All of these patients were submitted to passive tilt to different degrees of inclination (range 38 degrees to 60 degrees; average 50.5). The heart rate and blood pressure were again measured after one minute of being in the tilted position. In nine of these patients (three with traumatic paraplegia and six with traumatic quadriplegia) the study was repeated after fitting of a pressure suit (Armed Forces "G" suit) inflated to  $\pm 30$  cms. of water. This permitted maintenance of a uniform



external pressure on the lower extremities and the anterior part of the abdomen. The results of this study indicate that orthostatic hypotension was pronounced in individuals with traumatic quadriplegia while those with traumatic paraplegia had a slight decrease in systolic pressure but were able to keep an adequate diastolic pressure. The application of a "G" suit permitted maintenance of adequate systolic and diastolic pressures in most individuals with traumatic quadriplegia. The results of this study suggest that the application of uniform pressure in the dependent parts of the body is efficient in counteracting orthostatic changes in cardiovascular dynamics. It is very likely that this results from compensation of the inability of the paralyzed muscles to maintain adequate venous return in the upright position. It is possible, also, that the external application of pressure enhances a compensatory effect mediated through multiple neurohumoral changes not clearly identified as yet. The results of this study suggest that uniform application of pressure may aid in the progressive conditioning of quadriplegic patients to passive tilt at the early phases of rehabilitation treatment.

**Use of Guanethidine in Control of Sympathetic Hyperreflexia in Persons with Cervical and Thoracic Cord Lesions: Preliminary Clinical Observations on its Effect on Hypertonicity of Somatic Musculature.**

JOHN S. YOUNG, M.D., Medical Director, Craig Rehabilitation Hospital, Denver.

A frequent complication of thoracic and cervical cord lesions is hyperreflexia of the sympathetic nervous system. Hexamethonium is useful in managing this condition; however, its side effects are formidable. Guanethidine, a drug which inhibits adrenergic transmitter substances, is more specific in its action providing easier management of sympathetic hyperreflexia. In a significant group of patients, it appears to be effective for control of this difficult clinical problem with small daily dosage. Side effects are hypotension, diarrhea and decreased hypertonicity of somatic musculature. Preliminary clinical observations on its effect on hypertonicity of somatic musculature are presented.

**Urinary Calculus in Patients with Multiple Sclerosis.**

NICHOLAS TIMCHINOV, M.D., and MIECZYSLAW PESZCZYNSKI, M.D., Highland View Hospital, Cleveland.

One hundred and sixty-five multiple sclerotic patients were evaluated to ascertain the incidence of stone formation. Calculi were found in 9.6 per cent of the male patients and in 12.5 per cent of the females. These figures lie within ranges other investigators estimated for calculus in neurological conditions in general. Analysis of the occurrence of calculus showed a trend towards a higher incidence in cases with indwelling catheters and/or urinary tract infections. Neurosurgery such as sympathectomy, obturator neurectomy, phrenic crush and anterior rhizotomy failed to demonstrate any effect upon stone formation. None of the patients were on a low calcium diet or special preventive treatment.

**Tension Myositis.**

HERMAN J. FLAX, M.D., Santurce, Puerto Rico.

Tension myositis is the resultant of poor body mechanics, weakened muscles, and occupational strain in emotionally unstable individuals. The main symptom is muscle pain, which may be localized or referred and may completely incapacitate some patients. The referred pain follows a definite pattern from localized primary and sometimes secondary "trigger points." Treatment consists in reassuring the patient that he has no organic disease, such as arthritis or cancer; and, correction of poor body posture, strengthening weakened muscles, and increasing impaired joint motion. The "trigger areas" may be injected with one per cent Procaine Hydrochloride Solution to break up the vicious circle producing pain. Therapy of the physical symptoms should not be emphasized, and mechanical supports should not be prescribed. Ataraxic drugs muddle the mind, and if they are given in dosage sufficient to produce muscle relaxation, most patients complain of somnolence. Most important, however, is to discuss the principle underlying cause of this condition, the anxiety tension state producing this psychophysiological syndrome. The patient must be made to understand that once he has developed emotional security, this maturity will cure his symptoms.

**Nerve Block in Neuromuscular and Musculoskeletal Disorders.**

MILTON HOLTZMAN, M.D., and OSVALDO MIGLIETTA, M.D., Department of Physical Medicine and Rehabilitation, New York Medical College, New York City.

In the rehabilitation of patients with neuromuscular and musculoskeletal disorders, nerve blocks should be part of the clinician's armamentarium. The diagnostic, prognostic and therapeutic usefulness of nerve blocks can be of extreme value in understanding and managing these disorders with specific reference to the accompanying problems of pain, vasospasm, deformity and spasticity. For example, by blocking the obturator nerve in the paraplegic, spasticity may be reduced and thus permit the evaluation of residual voluntary movement in the lower extremity. A clearer understanding of indications and applications should permit the clinician to make better use of this valuable office procedure.

## **FRIDAY, SEPTEMBER 1**

### **GENERAL SCIENTIFIC SESSION**

#### *Morning*

Presiding Officer — JOHN H. ALDES, Los Angeles

Assisting Officer — ERNEST W. JOHNSON, Columbus, Ohio

#### **Intermittent Positive Pressure Versus Tank Respirator for Prolonged Artificial Respiration in Poliomyelitis.**

PETER SAFAR, M.D.; KAROL HOFFMANN, M.D.; WARREN HOLTEY, M.D.; BARRET SCOVILLE, M.D.; HERMAN MOORE, M.D., and EVANS DIAMOND, M.D., Departments of Anesthesiology and Medicine, Baltimore City Hospitals, Baltimore.

During the 1960 poliomyelitis epidemic in Maryland 25 apneic patients were ventilated with volume-cycled intermittent positive pressure respirators. A routine was established which provided adequate ventilation and prevented major pulmonary complications. The routine included the use of large-bore cuffed tracheotomy tubes, humidification, artificial coughing and sighing, changing of position, sterile tracheo-bronchial aspiration and monitoring of ventilation. Five of the 25 patients died within three months. In two of the five patients, death could possibly have been prevented. Six of the survivors will require artificial respiration for an indefinite period of time. In addition, circulatory and respiratory parameters were studied in four patients both during positive pressure ventilation and during the use of the tank. The clinical results with the use of the tank during previous epidemics will also be presented. Positive pressure respiration as compared to tank respiration has both advantages and disadvantages, which were evaluated. Positive pressure respiration proved preferable to tank respiration.

#### **Breathing Patterns of Poliomyelitis Patients with Respiratory Paralysis.**

GERALD G. HIRSCHBERG, M.D., Berkeley, California.

Respiratory patterns of 45 poliomyelitis patients with a vital capacity below 30 per cent of their predicted normal were studied at the Respiratory and Rehabilitation Center, San Leandro, California. Electromyography, pneumography, fluoroscopy and clinical examinations were used to determine which muscles participated in ventilation. All of these patients had diaphragmatic paralysis to a greater or lesser extent. Fourteen had completely paralyzed diaphragms. With the exception of the three most severely involved patients, all used one or more groups of accessory muscles for quiet breathing. Details of the mechanism and effectiveness of abdominal, neck and chest breathing in these patients are discussed.

#### **Rehabilitation of the Tuberculous Patient After Thoracic Surgery.**

STEVEN S. BADER, M.D., Chief, Physical Medicine and Rehabilitation, VA Hospital, Rutland Heights, Mass.

In the rehabilitation of a patient after thoracic surgery adequate physical therapy, consisting of carefully detailed muscle reeducation is of greatest importance. Its objectives are to prevent deformity of trunk and upper extremities; to aid in reexpansion of the lung, if indicated; to restore normal range of motion and strength of the shoulder and trunk; to improve general posture; to prevent a "chest cripple," and to reach earlier termination of hospitalization. It is important to start muscle reeducation very early after surgery because atrophies and contractures develop very early. The early treatments have to be short, but the amount of exercise is

gradually increased. In the beginning the range of motion is limited, but gradual increase is shown with exercise activity. Later it is essential to try to give full range of motion in the use of the patient's arm and shoulder on the operated side in all directions. In a patient after thoracic surgery because of pulmonary tuberculosis additional adequate breathing exercises, consisting of diaphragmatic and/or basal costal or costal breathing, and cough training are of very great importance, because there is an abundant bronchial secretion after surgery and great difficulty in ventilating the remaining functionally active parts of the lung.

#### **Unilateral Removal of Ischial Tuberosity and Spinal Curvature in a C-5 Quadriplegic Patient: A Case Report.**

MIECZYSLAW PESZCZYNSKI, M.D., and NICHOLAS TIMCHINOV, M.D.,  
Highland View Hospital, Cleveland.

This is a presentation of some aspects of the case of a 27-year-old quadriplegic patient whose impairment resulted from trauma to the spinal cord eight years ago. Early in the course of her management the treatment of a decubitus included removal of the ischial tuberosity on one side only. The probable relationship of the lateral tilt of the pelvis in a sitting position to the gradual development of a curvature of the spine is considered. The influence of the curvature on upper extremity bracing as well as the attempts to treat the lateral pelvic tilt and the spinal curvature are discussed.

#### **Aspects of Rehabilitation of the Laryngectomized Patient.**

LI-CHING YEN CHEN, M.D., Instructor, Department of Physical Medicine and Rehabilitation, Columbia University, New York City; Assistant Chief, Physical Medicine and Rehabilitation Service, VA Hospital; HARRY H. SAMBERG, M.D., Clinical Instructor, Department of Rehabilitation Medicine, State University of New York, Downstate Medical Center; Chief, Physical Medicine and Rehabilitation Service, VA Hospital, and BERNARD FELSENSTEIN, M.A., Chief, Educational Therapy Section, Physical Medicine and Rehabilitation Service, VA Hospital, Brooklyn.

Data drawn from sixty-four laryngectomized patients are evaluated with regard to age incidence, drinking and smoking habits, occupational background and present status, symptomatology, family history, speech retraining, survival periods, causes of death and autopsy findings. Photographs are shown of x-rays depicting the pharyngo-esophageal air column and its constriction presumably at the cricopharyngeus muscle at the approximate level of the 5th cervical vertebra.

#### **The Medically Oriented Speech and Hearing Center.**

HAROLD N. NEU, M.D., Professor of Medicine, Director of Rehabilitation Center, Creighton Memorial St. Joseph's Hospital, and JOHN A. MCGEE, M.A., Chief of Speech and Hearing Therapy Center, Creighton Memorial St. Joseph's Hospital, Omaha.

Recent surveys indicate that there are about six and one-half million people in the United States with some degree of speech and hearing disorder limiting communication. The Rehabilitation Center at Creighton University School of Medicine and the Nebraska Society for Crippled Children and Adults has established a program of medical education designed to integrate the speech and hearing center into the general health programs throughout the country. This paper discusses the concept of the medically-oriented speech and hearing relative to the role of the speech and hearing center; the need for such a center; how such a center may be established; the operation of the center, and the financing of the center. Since such a program requires intensive orientation of the medical profession, the second phase of the paper treats the integration of the center concept into medical education through a speech and hearing conference and demonstration clinic maintained by grants from the Nebraska Society for Crippled Children and Adults. This program has been in operation for approximately two years and the outcome should be of great interest to those concerned with the entire field of rehabilitation.

#### **Modification of Anxiety Through Hypnosis in Physical Medicine.**

FOLKE BECKER, M.D., Chief, Physical Medicine and Rehabilitation Service, VA Center, Dublin, Ga.

Anxiety is medically defined as a feeling of apprehension, uncertainty and fear. Situation anxiety occurs when beginning some undertaking not necessarily related to disability or disease, but frequently associated with it. Feelings of apprehension, uncertainty and fear may persist throughout the undertaking and may even become magnified during its course, thus presenting a well-known and serious obstacle to treatment procedures. In selected cases, anxiety can be modified by hypnosis to the extent of achieving relaxation and improved concentration on the part of the patient. Medical hypnosis, when not contraindicated, is a valid modality in physical medicine where patient anxiety presents interference with neuromuscular function. The objective involved is that of producing and maintaining a state of increased suggestibility through autoconditioning.

## SCIENTIFIC FILMS

Scientific films will be shown during the week of the session. The final program will carry the daily and hourly schedule of the films.

### **Independent Living from "Home" in a Hospital.**

*Color, sound, 25 minutes.*

Presented by Karl H. Haase, M.D., Los Angeles.

*This is a followup to the paper, "Intensive Physical Medicine and Rehabilitation Therapy 'At Home' While in the Hospital," presented to the 3rd International Congress of Physical Medicine in Washington, D.C., 1960. This is an approach to patient treatment utilizing a "Home" setting in the hospital as opposed to the classical treatment areas used in most institutions. The film demonstrates that this "Home Program" can result in more realistic self-care training for the patient and the family's role following patient's discharge. It should be noted that this treatment area can be set up inexpensively in any institution using available facilities, such as, visiting rooms, solarium, etc.*

### **Rehabilitation in Paraplegia.**

*Color, sound, 31 minutes.*

Presented by Albin T. Jousse, M.D., Toronto, Ont., Canada.

*The film portrays the management and care of the spinal paraplegic from the time of admission to the rehabilitation center until date of discharge. Bed exercises, the need for skin care, prevention of deformities—at the bedside and in the pool are emphasized. Group activities are shown, including calisthenics. The patient's progress is recorded until he has achieved personal self-sufficiency and is ready to return to work. A short section deals with the urological care, tidal irrigation, the need for G.U. reviews by a competent urologist and the factors which must be controlled if good health is to be preserved. It was designed for the teaching of therapists, nurses, medical students and possibly medical associations.*

### **Cinefluorographic Studies of the Wrist.**

*Black and white, silent, 15 minutes.*

Presented by Gordon M. McFarland, M.D., and Ursula L. Krusen, M.D., Dallas, Texas

*Studies of the wrist by cinefluorographic technics demonstrate vividly the close tolerances and interrelations of carpal mechanisms. The studies were carried out on normals for comparison with abnormals. Equipment consisted of a 14-inch research cinefluorograph and a five-inch image amplifier clinical cinefluorograph.*

### **The Disability Decision.**

*Black and white, silent, 30 minutes.*

Presented by William Roemmich, M.D., Social Security Administration, Baltimore.

*The nation's physicians daily are asked by patients to provide medical reports to support claims for disability benefits under the social security disability program. Thousands of attending physicians have furnished the medical reports which have been a primary basis for reaching disability determinations, and in meeting a prime objective of this program, for assessing claimants' potential for rehabilitation services. Using several challenging case histories, "The Disability Decision" clarifies the physician's role in the social security disability program—the kind and extent of medical information he is asked to provide—and how that information is used in determining whether his patient is disabled within the meaning of the social security law.*

**Long-Term Artificial Respiration.***Color, sound, 20 minutes.*

Presented by Peter Safar, M.D., Baltimore.

*Long-term artificial respiration technics with the use of "fixed volume" piston respirators and cuffed tracheotomy tubes are shown as performed on poliomyelitis patients. Broadened indications for respirator care are discussed. Details of monitoring of ventilation, nursing care, artificial coughing and sighing, and sterile tracheotomy care are shown with the use of this technic. A comparison is presented with the use of the iron lung. The ease of physical therapy with the use of the positive pressure technic is discussed.*

**SCIENTIFIC EXHIBITS**

Scientific exhibits will be on display during the week of the 39th annual session on the Mezzanine Floor. These exhibits will be open to viewing at 8:30 a.m. on Tuesday, August 29, 1961 through 3:00 p.m. on Thursday, August 31, 1961. Medals will be awarded to those exhibits which are adjudged outstanding by the Committee on Awards and Prizes. The awards will be announced and presented at the dinner on Wednesday, August 30.

**A Team Approach—Prosthetics and Orthotics in the U.S.A.**

American Board for Certification on Orthotics and Prosthetics Inc., LeRoy W. Nattress, Jr., Executive Director. Washington, D.C.

*Of the many characteristics that typify prosthetics and orthotics in the United States today, three are outstanding. They may be generically described as THE TEAM APPROACH; THE CONCERN WITH THE INDIVIDUAL PATIENT, and TOTAL REHABILITATION. Although these three elements in the treatment of the disabled can be discussed as separate entities, in actual practice they are rightfully treated as one. The TEAM acts as an integral unit to help the INDIVIDUAL paralytic or amputee to achieve TOTAL REHABILITATION. Each element is indispensable to the success of the other two. The purpose of this exhibit is to visualize these three characteristics as they interact with each other to provide for the successful rehabilitation of the disabled.*

**Patella Tendon Bearing Below Knee Prosthesis.**

Miles H. Anderson, Ed.D., and Ralph E. Worden, M.D. Los Angeles.

*This exhibit shows the new below knee artificial leg that uses a soft insert in the socket, is designed to bear a significant portion of the amputee's weight on the patella tendon, and is so fitted and aligned that it does not usually require the use of side joints and leather thigh corset. On the display is one of these limbs cut in half to show the cross-sectional view in the anterior-posterior plane. The manner in which the plastic socket is faired into the plastic shin can be clearly seen. The soft leather cuff-type suspension strap system is also shown. The adjustable shank which is used to dynamically align the prosthesis is shown complete with the socket and foot assembly. The emphasis is on the problem of gait-training, as the amputee must be taught to walk with a flexed knee, instead of with the knee extended, as with the usual prosthesis for a below-knee amputee. A lesson sheet illustrating gait faults, their cause, and remedies is available for those interested.*

**Normal and Fair Muscles in Childhood Quantitative Standards.**

Willis C. Beasley, Ph.D. Bethesda, Md.

*Five panels of illustrations showing: methods of measuring normal muscular forces, segmental gravitational component forces, distributions of measurements on 600 children 10-12 years of age, derivations of standard values for Normal and Fair muscles.*

**Spine Instrumentation in the Management of Scoliosis.**

Paul R. Harrington, M.D. Houston, Texas.

*This exhibit entitled "Spine Instrumentation in the Management of Scoliosis" is presented in two sections: 1) biomechanics of the spine, 2) management of scoliosis by instrumentation (case presentation). Biomechanics presented by Dr. James R. Simms, Chairman of the Department of Engineering, Rice University. The demonstration of spines and X-rays as well as theoretical engineering description compose the biomechanic section. An operative model demonstrating the exposure and the anchor sites for instrumentation in the posterior elements of the spine is*

included. The case presentation includes some thirty cases demonstrating the various adaptive circumstances for axial skeleton correction, stabilization and fixation. The development with final result tabulations are presented. Study in the past thirteen years to its present developments in management of scoliosis proceeded in the following pattern: Group I—19 cases developing a metallic system; Group II—46 cases as a research group evaluating and refining the metallic system; Group III—The adaptive group—69 cases.

#### **A Device for Easier Management and Rehabilitation of the Paraplegic and Quadriplegic.**

Ki Ho Kim, M.D., and Frank P. Travisano, B.S. West Orange, N. J.

The importance of tilt tables, wheelchairs and patient lifts for the quadriplegic and paraplegic patient are well-established in the practice of rehabilitation. This new device combines all three. It will save space and money and afford mobilization and easier management of the patient. While assistance is available at the rehabilitation center, new problems arise for the patient when he goes home. He is faced with the financial difficulty of maintaining attendants, or the more frustrating problem of his family's inability to help him. To discontinue exercises hastens physiologic changes in the body. The answer to these problems has been sought for some time now and this device may serve the needs of these patients. **CHARACTERISTICS**—1. Versatile in nature: (a) Self-Stander, (b) Patient Lift, (c) "High-low" litter, (d) "High-low" examining table, (e) "High-low" tilt table, (f) "High-low" wheelchair; 2. Accessories: (a) "Lap Board" that becomes a "Stand-In" table when wheelchair is elevated to standing position, (b) Crutch arms, (c) Cervical hook and Sayer Sling, (d) Knee support, (e) Restraining strap; 3. Two sizes: (a) Large to medium, (b) Medium to small; 4. Hydraulically operated and powered by long-life rechargeable battery. 5. Sturdy tubular construction.

#### **Traumatic Affections of the Cervical Spine.**

Eugene G. Lipow, M.D., and O. Hugh Fulcher, M.D. Washington, D. C.

This exhibit consists of three dimensional anatomical true color model representations of the more common traumatic affections of the cervical spine. Causes of cervical root syndrome, cord involvement, dislocations of intervertebral discs, fractures and dislocations of cervical vertebrae and their complications all are shown. Treatment in some of these conditions is also indicated.

#### **Habilitation of the Mentally Deficient Child.**

Henry V. Morelewicz, M.D. Buffalo, N. Y.

This exhibit will attempt to demonstrate present methods of evaluation of a mentally retarded child to determine if he is educable, trainable or not a candidate for a planned program. Present methods of training and teaching will be demonstrated both by poster and pictures. These methods have been developed at St. Rita's Home for Children in Getzville, N. Y. for the past 18 years. A review of the present future plan will be demonstrated pictorially to bring out how the trainable child can be accepted by the parents to live in a normal community with normal children.

#### **County Hospital Physical Medicine and Rehabilitation.**

Stanley Olejniczak, M.D. Eloise, Michigan.

The exhibit, "Physical Medicine and Rehabilitation in a County Hospital," illustrates in trans-illuminating pictures, the chief functions of the department in the total care of patients. It shows step-by-step, how the goals of total rehabilitation are reached. At first, through employment of different modalities and physical activities step one is reached, which is the physical, functional independence. The second step is the return to gainful employment through vocational training. There are two drawings, one showing the disheartening situation of the wheelchair-bound amputee, and second, the problem, "to be or not to be rehabilitated to a useful citizen."

#### **Electrodiagnosis in the Rehabilitation of the Pediatric Patient.**

Bernard S. Post, M.D.; Sigmund Forster, M.D., and Joseph G. Benton, M.D. Brooklyn, N. Y.

This exhibit will embody a visual presentation of the use of electrodiagnosis in clinical entities common to the pediatric patient referred to the physiatrist for rehabilitation as well as diagnosis. It will stress the use of the various procedures in electrodiagnosis as an adjunct in determining the accurate diagnosis, extent of disability and the setting up of a sensible rehabilitation goal that is realistic. A combination of photographs of the various modalities applicable in each case together with resultant recordings of such tests will be presented. Particular attention will be paid to the application of electromyography in these cases.



**The Disability Decision.**

William Roemmich, M.D., Social Security Administration. Baltimore.

*This exhibit, "The Disability Decision," is designed to give physicians a quick insight into their role in providing medical evidence for patients who file applications for social security disability benefits. The exhibit has three rotating sections, each section bearing a part of the complete message. The three messages show the kinds of medical facts a doctor's report should include for the administrative agency to reach a prompt and equitable decision of disability. The first of the rotating messages deals with history and physical findings; the second message emphasizes the need for laboratory data; and, the third panel points up the need for information about the patient's residual capacity for work. Each side panel contains a stationary message. The panel on the left side has the following: "You can help your patient with a complete and prompt medical report." The panel on the right side states: "A complete medical report—A primary basis for reaching the decision: Is your patient disabled under the social security law?"*

**Iontophoresis: Historical, Experimental, Clinical.**

Harry T. Zankel, M.D. Durham, N. C.

*The exhibit will portray the key historical steps in the development of iontophoresis from Galvani's frog experiment to the present. The experimental work dealing with the effects of various modalities on iontophoresis using a radioactive tracer will be outlined. The present accepted clinical application of iontophoresis will be indicated.*



## TECHNICAL EXHIBITS

**AMERICAN WHEEL CHAIR DIVISION — Booth 10**

AMERICAN WHEEL CHAIR DIVISION will have on display representative models of its complete line of quality wheel chairs, walkers, getabout chairs, and commodes. The AMERICAN Line includes wheel chairs with Removable arms, Interchangeable Footrests and Legrests, Reclining Backs, and new developments in Rehabilitation Equipment. Featured will be the AMERICAN SUPREME with Removable, Reversible, Adjustable Height Arms.

**THE BURDICK CORP. — Booths 1, 2 and 3**

The Burdick Corporation will display representative items of their modern line of physical medicine equipment including ultrasonic (continuous and pulsed), conventional and microwave short wave Diathermy and electrical stimulating equipment.

**S. H. CAMP & COMPANY — Booth 12**

S. H. Camp and Company will display their new "Cold Label" line of both men and women's back supports. Their newly designed back panels make the additional splinting with steel stays conform to the make-up of the bony structure of the body. There are new aluminum Flexion, Knight and Taylor Braces; an ankle brace that allows free flexion and extension, resists inversion. A Taylor Insert for use with any Camp Lumbrosacral support. These and many other items of interest to you can be seen at the Camp booth.

**CHATTANOOGA PHARMACAL CO., INC. — Booth 9****HYDROCOLLATOR — A STANDARD IN PHYSICAL MEDICINE**

Welcome to the HYDROCOLLATOR booth. We will be looking forward to seeing our many Hydrocollator users again this year, to discussing any particular problems with which we can help, and to express our sincere thanks for your continued use of our products. The latest versions of all four models of our Hydrocollator Master Units will be on display. For those of you who are not already using the Hydrocollator, there will be a continuous demonstration. Don't fail to take advantage of this opportunity to feel for yourself the intense, soothing Moist Heat of this application. See its amazing simplicity and convenience. Learn the many advantages of the Hydrocollator in your work.

**THE COCA COLA CO. — Booths 20 and 21**

Ice-cold Coca Cola served through the courtesy and cooperation of The Cleveland Coca-Cola Bottling Co., and The Coca-Cola Company.

**DYNA-WAVE CORPORATION — Booth 39**

DynaWave delivers unidirectional, short duration electric current, continuously adjustable from zero to 500 volts. Sufficient potential to reach deep underlying tissue, yet very low sensory disturbance.

**ELGIN EXERCISE APPLIANCE CO. — Booth 11**

The originators and manufacturers of PROGRESSIVE RESISTANCE EXERCISE EQUIPMENT again provide you with the latest designed equipment. The NEW ELGIN EXERCISE CHAIR is ideal where space is limited. Excellent for resistive, assistive, or reciprocal motion exercises. THE ELGIN EXERCISE UNIT—MODEL A-1500 used in hospitals, physical medicine and rehabilitation centers throughout the world, is on display at the Elgin booth.

**EMG ASSOCIATES — Booth 23**

The DISA ELECTROMYOGRAPH, used at leading institutions throughout the world for clinical routine and research, combines superior electronic design with simultaneous three channel viewing and built-in photographic recording. DISA NEEDLE ELECTRODES, including DISA MULTIELECTRODES, offer low noise and long life. The DISA MULTISTIM enables versatile stimulation of muscle and nerve.

**EVEREST & JENNINGS INC. — Booths 24, 25 and 26**

Everest & Jennings will exhibit many new products in the hospital and rehabilitation fields. We invite you to visit our booth for complete information and be sure to pick up your free notebook and pencil.

**FLORIDA BRACE CORP. — Booth 37**

Florida Brace Corporation invites you to visit their booth to see the Jewett Hyperextension Back Brace for all cases requiring positive hyperextension such as simple compression fractures, Marie Strumpell's Disease, etc. They also have on display the Davidson-Jewett Flexion Brace; the FBC Abduction Splint; and various types of adjustable cervical collars.

**GERIATRIC PHARMACEUTICAL CORP. — Booth 31**

Geriatric Pharmaceutical Corporation, pioneers in geriatric research, will exhibit GER-O-FOAM, an anesthetic analgesic which, when massaged into musculoskeletal involvements, will relieve pain in minutes and last for hours. Physiatrists believe GER-O-FOAM to be a contribution in the field of physical medicine. We will also exhibit GAYSAL for the management of the arthritides. Our representatives, well experienced with physiatrists, will be glad to discuss the products with you.

**THE R. D. GRANT CO. — Booth 35**

The Airmass APP Unit helps prevent decubital ulcers and promotes healing of existing bedsores. APP Units are now used in most hospitals in the United States for prevention and treatment of decubiti. They have proved effective in thousands of cases, affording much relief of extra nursing burden.

**J. E. HANGER, INC. — Booth 27**

Modern prosthetic devices for upper and lower extremity amputees will be displayed by the Hanger organization who offer a complete service to the amputee. A representative will show you the Hanger Suction Socket Limb and the recent improvements for upper extremity prostheses.

**HEINICKE INSTRUMENTS CO. — Booth 19**

Heinicke Instruments will exhibit the Heinicke Walkalator, a transistorized device weighing less than a pound, directing electric stimuli to the ambulatory muscles in timed sequence to produce the motion of walking in paraplegics, stroke victims, etc. The Walkalator is principally a therapeutic device, designed to re-educate the brain. It is activated and programmed by a switch in the heel of the shoe, completely portable, energized by small rechargeable mercury cells.

**ILLE ELECTRIC CORP. — Booth 8**

**PHYSICAL THERAPY EQUIPMENT:** Ille Electric Corporation welcomes you to Booth No. 8 to see the latest available units for the after-care treatment of fractures, and for muscle improvement of many disabling conditions. They will display the New Long and Low Whirlpool, Moisture Heat Therapy Unit and Paraffin Bath.

**JOBST INSTITUTE, INC. — Booth 22**

Obstinate & Massive Edema of the extremities successfully reduced and controlled with the Jobst Intermittent Compression Units, Pneumatic Appliances and Jobst Pressure Gradient Supports. The Jobst program has been clinically proved on thousands of patients. Also shown will be the new Pneumatic Stump Shrinkers and a new foot exerciser for controlling dependent edema.

**LA BERNE MFG. CO., INC. — Booth 41**

LaBERNE will exhibit:

1. A portable Ankle Exerciser, with controlled resistance for eversion, inversion, dorsiflexion and plantar flexion exercise.
2. A Pronator-Supinator, offering selected pronation or selected supination, with controlled resistance for either.
3. The new hydraulically controlled LaBERNE Extension-Flexion Exercise Unit with pressure setting through hydraulic gauge for exercising the knee muscle group.
4. The LaBERNE Shoulder Rotator, for internal and external rotations.
5. The LaBERNE Hip-Rotator.

**M. J. MARKELL SHOE CO., INC. — Booth 18**

Tarso Supinator, Tarso Pronator and Tarso Medius shoes for children will be displayed—also a variety of night splints. Tarso Shoes are prescribed for brace and splint work. They are also made for treatment of varus and valgus foot problems of CP and post-polio children. Tarso shoes are supplied to orthopedic shoe stores, brace shops and hospitals everywhere. They are ready made and in stock. Tarso shoes have been prescribed for nearly 30 years.

**MEDCO PRODUCTS CO. — Booth 13**

Presenting the MEDCO-SONLATOR. Providing a new concept in therapy by combining muscle stimulation and ultra sound simultaneously through a SINGLE Three-Way Sound Applicator. The MEDCO-SONLATOR is a distinct advance in the effectiveness of physical therapy in your office or hospital. A few minutes spent in our booth should prove of value to your practice.

**THE MEDITRON CO. — Booth 44**

NEW: Miniaturized transistor EMG REHABILITATION UNIT for muscle re-education. NOW the patient can carry the EMG with him. NEW: Miniaturized NERVE LOCATOR-STIMULATOR for precision nerve blocks, identification, and determination of viability. NEW: Finest quality EMG instrumentation ever offered. NEW: Complete research system built to your specifications.

**MIDWEST IMPORTS — Booth 36**

The PHYSICAL MEDICINE DIVISION of MIDWEST IMPORTS, HINSDALE, ILLINOIS will exhibit the complete SIEMENS line, consisting of: ULTRATHERM, short-wave diathermy machines with automatic tuning and deep-field efficiency—the most advanced in this field; special coil field electrodes are shown. SONOSTAT, ultrasonic generator featuring a dosage tabulator, also a new low volt unit employing neo-dynamic currents.

**J. A. PRESTON CORP. — Booths 15 and 16**

Welcome to our friends from everywhere. For your visit, we are exhibiting some interesting new developments from our Complete Line: DIAGNOSTIC APPARATUS featuring a new Skin Temperature Unit; Exercise Apparatus; Electro-Medical Equipment; Selected BOOKS. For information on all items, register for your free copy of the PRESTON CATALOG No. 1065—over 200 pages, 1057 illustrations—the MOST COMPLETE Catalog in the Field.

**REHABILITATION PRODUCTS — Booth 42**  
(Division of American Hospital Supply Corp.)

Selected products for Physical Medicine and Rehabilitation: Electro-Therapy Equipment, Invalid Walkers, Washex Automatic Toilet Seat, Tomac All-Purpose Table, Circulator, Tomac Snap-ON Covers for Hydrocollator Packs, Miller Twister, American Wheel Chairs, Traction Devices, Exercise Equipment and Self-Help Items. Register for our new R/P Bulletin. Our Staff of specialists—our 160 sales representatives—our 14 regional offices are all eager to provide you with "national service on a local level."

**RISE-O-MATIC CHAIR CO. — Booth 29**

The RISE-O-MATIC CHAIR, created for people with limited muscular control of the lower body, provides physical independence and therapeutic help to cases of Muscular Dystrophy, Arthritis, and Paraplegias of all types. Cardiovascular accidents, infantile paralysis, as well as the disabilities of old age can also be helped. Electrically operated, the RISE-O-MATIC CHAIR gently elevates the patient from a seated to a standing position—enabling him to walk away without help. By reversing the procedure, the patient is returned from a standing to a seated position. Easily adapted to size, it is available both as a conventional chair and wheelchair.

**SPENCER, INC. — Booth 14**

Every Spencer Support is individually designed, cut and manufactured according to prescription needs, for men, women or children, to assist in corrective and rehabilitative treatment. You are cordially invited to visit the Spencer booth to see samples of our supports or to inquire about supports for the specific requirements of individual patients. Ask about our Emergency Service for patients requiring immediate support.

**SYNCARDON OF AMERICA, INC. — Booth 40**

Syncardon for peripheral vascular disorders. The Syncardon is designed to furnish pneumatic pressure impulses to an extremity for an exact measured time in perfect synchronization with each pulsation from the heart. Thus, a local increase in intra-arterial pressure forces more blood through any small arteries and arterioles capable of dilation.

**TECA CORPORATION — Booth 28**

New TECA Electromyographs and Chronaximeters for electrodiagnosis of neuromuscular diseases will be shown. Apparatus for performing nerve conduction velocity tests, chronaxie determinations, strength duration curves and other procedures in electrodiagnosis will be demonstrated. See also a complete line of TECA therapeutic low volt generators and muscle stimulators. Technical personnel will be on hand to provide complete information.

**THERATRON CORPORATION — Booth 38**

Theratron Corporation, development pioneers of miniaturized electro-therapeutic devices, will display the Theratron Muscle and disposable electrodes. The Theratron Muscle is a compact stimulator worn on the belt of individuals to restore function to muscles rendered useless through disease or injury. Lower extremity brace elimination is possible in many cases.

**THERMO-ELECTRIC CO. — Booth 34**

The Dickson Paraffin Baths were designed and developed in cooperation with Cleveland Hospitals where they have been in constant use for twenty years. All models are equipped with a drain for easy cleaning. The mahogany moulding around the top of the Bath affords comfort for the patients. Truss construction permits easy handling of the Baths. Two models will be shown.

**TRU-EZE MFG. CO., INC. — Booths 6 and 7**

OPTIMAL RESULTS! IMPROVED DEVICES! EXTRA HANDS for your busy personnel! A visit to our booth will show the simplicity of providing effective traction without additional help. See demonstrated the TRACTOMATIC, portable intermittent traction machine; the "TRU-TRAC" Traction and Therapy Table with free-wheeling ball-bearing rollers to reduce friction; also the "TRU-TRAC" Flexion Traction Chair. See the ORIGINAL and improved traction sets for home use on display.

**WHITEHALL ELECTRO MEDICAL CO., INC. — Booth 30**

Don't miss seeing the Whitehall "LoBoy" Whirlpool Bath—the original whirlpool with the LOW tank profile, offering greater comfort and easy access into and out of the tank. Also on display, the AQUA/WHIRL Portable Whirlpool Bath for use in any bath tub. WHITEHALL sets the pace in hydrotherapy equipment.

**LIST OF EXHIBITORS**

*For the convenience of those who wish to write to exhibitors after the meeting, the local addresses of all of the firms exhibiting at this meeting are listed herein.*

**- A -**

American Wheel Chair Division—Institutional Industries, Inc.  
5500 Muddy Creek Rd., Cincinnati 28, Ohio

**- B -**

The Bardick Corporation  
Milton, Wis.

**- C -**

S. H. Camp and Company  
109 W. Washington, Jackson, Mich.  
Chattanooga Pharmacal Co., Inc.  
2400 Dayton Blvd., Chattanooga, Tenn.  
The Coca-Cola Company  
P.O. Drawer 1734, Atlanta 1, Ga.

**- D -**

DynaWave Corporation  
P.O. Box 696, Staunton, Va.

**- E -**

Elgin Exercise Appliance Company  
P.O. Box 132, Elgin, Ill.  
EMG Associates  
20 East 68th St., New York 21, N. Y.  
Everest & Jennings, Inc.  
1803 Pontius Ave., Los Angeles, Calif.

**- F -**

Florida Brace Corporation  
P.O. Box 1366, Winter Park, Fla.

**- G -**

Geriatric Pharmaceutical Corporation  
45 Commonwealth Blvd., Bellerose, L. I., N. Y.  
The R. D. Grant Company  
761 Hippodrome Bldg., Cleveland 15, Ohio

**- H -**

J. E. Hanger, Inc.  
221 G St., N.W., Washington 13, D.C.  
Heinicke Instruments Company  
2035 Harding St., Hollywood, Fla.

**- I -**

Ile Electric Corporation  
Reach Rd., Williamsport, Pa.

## - J -

Jacuzzi Research, Inc.  
1440 San Pablo Ave., Berkeley 2, Calif.  
Jobst Institute, Inc.  
1803 Jefferson Ave., Toledo, Ohio

## - L -

La Berne Manufacturing Company, Inc.  
P.O. Box 5245, Columbia, S. C.

## - M -

M. J. Markell Shoe Co., Inc.  
332 S. Broadway, Yonkers, N. Y.  
Medco Products Company  
3601 E. Admiral Pl., Tulsa, Okla.  
The Meditron Company  
5440 N. Peck Rd., El Monte, Calif.  
Midwest Imports—Physical Medicine Division  
P.O. Box 322, Hinsdale, Ill.

## - P -

J. A. Preston Corporation  
71 Fifth Ave., New York 3, N. Y.

## - R -

Rehabilitation Products—  
Division of American Hospital Supply Corporation  
2020 Ridge Ave., Evanston, Ill.  
Rise-O-Matic Chair Company  
2547 Traymore Rd., Cleveland 18, Ohio

## - S -

Spencer, Inc.  
Box 1710, New Haven, Conn.  
Syncardon of America, Inc.  
9th & Chestnut Sts., Seymour, Ind.

## - T -

Teca Corporation  
80 Main St., White Plains, N. Y.  
Theratron Corporation  
263 Griggs-Midway Bldg., St. Paul 4, Minn.  
Thermo-Electric Company  
2372 West 7th St., Cleveland 13, Ohio  
Tru-Eze Manufacturing Company, Inc.  
426 S. Varney St., Burbank, Calif.

## - W -

The Whitehall Electro Medical Co., Inc.  
19 Wall St., Passaic, N. J.





**AMERICAN CONGRESS OF PHYSICAL MEDICINE  
AND REHABILITATION**

**39th Annual Session**

*Preliminary Schedule of Daily Activities*

**Friday, August 25**

- 10:00 Meeting: Editorial Board, Archives of Physical Medicine and Rehabilitation
- 2:00 Meeting: Board of Governors, American Congress of Physical Medicine and Rehabilitation

**Saturday, August 26**

- 9:00 Meeting: Board of Governors, American Congress of Physical Medicine and Rehabilitation
- 10:00 Meeting: Editorial Board, Archives of Physical Medicine and Rehabilitation
- 7:00 Dinner: Editorial Board, Archives of Physical Medicine and Rehabilitation

**Sunday, August 27**

- 10:00 Registration
- 10:00 Meeting: Board of Governors, American Congress of Physical Medicine and Rehabilitation
- 10:00 Meeting: Advisory Committee for Advancement of Physical Medicine and Rehabilitation, American Academy of Physical Medicine and Rehabilitation
- 10:00 Meeting: Veterans Administration Consultants
- 2:00 Meeting: Board of Governors, American Academy of Physical Medicine and Rehabilitation

**Monday, August 28**

- 8:00 Registration
- 9:00 Scientific Session: American Academy of Physical Medicine and Rehabilitation
- 10:00 Coffee Hour: Hostesses, Women's Auxiliary, American Congress of Physical Medicine and Rehabilitation
- Noon Luncheon: Woman's Auxiliary, American Congress of Physical Medicine and Rehabilitation
- 2:00 Scientific Session: American Academy of Physical Medicine and Rehabilitation
- 4:00 Annual business meeting, American Academy of Physical Medicine and Rehabilitation (members only): *current AAPM&R membership card must be presented for admittance to this session*

**Tuesday, August 29**

- 8:00 Registration — Inspection of Exhibits
- 9:00 Scientific Session: American Congress of Physical Medicine and Rehabilitation
- 9:00 Scientific Session: American Congress of Physical Medicine and Rehabilitation
- 10:00 Coffee Hour: Hostesses, Woman's Auxiliary, American Congress of Physical Medicine and Rehabilitation
- Noon Luncheon — Inspection of Exhibits
- 2:00 Plenary Session: American Congress of Physical Medicine and Rehabilitation
- 4:00 Annual business meeting: American Congress of Physical Medicine and Rehabilitation (first session — members only) — *current ACPM&R membership card must be presented for admittance to this session*
- 7:30 Annual business meeting: American Congress of Physical Medicine and Rehabilitation (second session — members only) — *current ACPM&R membership card must be presented for admittance to this session*  
Meeting: Executive Council, American Congress of Physical Medicine and Rehabilitation

**Wednesday, August 30**

- 8:00 Inspection of Exhibits
- 9:00 Scientific Session: American Congress of Physical Medicine and Rehabilitation
- 10:00 Coffee Hour: Hostesses, Women's Auxiliary Congress of Physical Medicine and Rehabilitation
- 10:00 Scientific Films (continuous showing)
- 10:50 Scientific Session: American Congress of Physical Medicine and Rehabilitation
- Noon Luncheon — Inspection of Exhibits
- 2:00 Scientific Session: American Congress of Physical Medicine and Rehabilitation
- 2:00 Scientific Session: American Congress of Physical Medicine and Rehabilitation
- 7:00 Congress/Academy Annual Dinner

**Thursday, August 31**

- 8:00 Registration — Inspection of Exhibits  
9:00 Scientific Session: American Congress of Physical Medicine and Rehabilitation  
10:00 Scientific Films (continuous showing)  
Noon Luncheon — Inspection of Exhibits  
Noon Luncheon and Meeting, VA Personnel  
2:00 Scientific Session: American Congress of Physical Medicine and Rehabilitation  
2:00 Scientific Session: American Congress of Physical Medicine and Rehabilitation  
4:00 Annual business meeting: American Congress of Physical Medicine and Rehabilitation (third session — members only) — *current ACPM&R membership card must be presented for admittance to this session*

**Friday, September 1**

- 8:30 Registration  
9:00 Scientific Session: American Congress of Physical Medicine and Rehabilitation  
9:00 Meeting: Board of Governors, American Congress of Physical Medicine and Rehabilitation  
2:00 Meeting: Board of Governors, American Academy of Physical Medicine and Rehabilitation



## ★ book reviews ★

CLINICAL ORTHOPAEDICS, No. 18: Internal Derangement of the Knee Joint. Edited by *Anthony F. DePalma*, M.D. Cloth. Price, \$7.50. Pp. 293, with illustrations. J. B. Lippincott Company, E. Washington Square, Philadelphia 5, 1960.

Volume 18 of this popular series is divided into three sections. The first and principal section is devoted to internal derangements of the knee joints, containing 15 chapters. Among the 15 chapters there are two on arthrodesis of the knee, two on injuries of the ligaments of the knee, two on popliteal cysts, two on meniscal lesions, one on a tibial plateau prosthesis, two on cartilage degeneration, and one on operation for recurrent dislocation of the patella, and the last one is on the short, below-knee amputations. There are many interesting and up-to-date observations on the knee joint in this section; however, frequently there are contradictory statements in adjoining chapters. This may be satisfactory for a journal which contains editorial comment, but it seems out of place in a book which is a more permanent volume. The one, somewhat controversial chapter was on short below-knee amputation in which the author suggested that a short below-knee was an excellent end-bearing stump. Unfortunately, the author is apparently unaware of the advantages of the patellar tendon bearing, cuff suspension prosthesis, and thus would be in the dark about the need for a longer stump. Certainly that chapter was satisfactory 10 years ago, but in the past three to four years, it is doubtful that any surgeon would electively select a short, below-knee amputation if the pathology would allow a longer one. The review of diagnostic signs in ligament and meniscal injuries of the knee were excellently illustrated and explained. Section II is devoted to general orthopedics with a variety of subjects of current interest discussed. A particularly interesting chapter to the physiatrist was Chapter 24 on bicipital tenosynovitis. Section III was devoted to two short items, one on stress fractures of the sesamoid bones of the foot, which was particularly interesting, and a method of reduction of the dislocated hip without anaesthesia, a case report. A feature of this volume which is excellent is the first chapter which is devoted to a biography of one of the outstanding orthopedists, Doctor Fremont A. Chandler. Since this type of volume simply represents

a different kind of journal, the attractiveness and permanency of the binding is outweighed by the inability to remove the articles of particular interest to the individual reader. In general, the volume contains much useful information. However, I cannot help but wonder if a more systematized approach to the internal derangement of the knee joint, the principal subject of the book, would not have made it more valuable. The type is easy to read and the illustrations and line drawings, particularly the reproductions of the x-rays, are excellent. (*Ernest W. Johnson, M.D.*)

EVALUATION AND MANAGEMENT OF THE BRAIN-DAMAGED PATIENT. By *Jerome S. Tobis*, M.D. and *Milton Lowenthal*, M.D. Cloth. Price, \$6.00. Pp. 109, with illustrations. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill., 1960.

This excellent monograph succeeds as a fine example of a much needed new approach to the study of the care of the brain damaged. The emphasis is shifted from the diagnosis of the disease process to evaluation and management in terms of function. The orientation throughout is from this physiologic standpoint which makes it a practical text for the many groups working in the field of physical medicine and rehabilitation. Beginning with a section on theoretical considerations of brain damage and convalescence, the authors provide a functional frame of reference in which to view evaluation and management. Disability is presented as a dynamic process rather than a fixed state, "whatever the illusory stationary character that it may have." Therefore, included in the review are some aspects not traditionally included in the subject of brain damage such as growth and development and cardiovascular function. It is stressed that recovery is dependent not solely on the anatomical lesion but rather on the total physiologic adjustment of the organism to the tissue changes. The expression of a physiologic disorder by somatic symptoms (as in hysteria) and the delusional denial of somatic symptoms (as in anosognosia) are presented as opposite facets of the same mechanism. Therefore, functional and organic disturbances are not viewed separately but as two aspects of the same phenomenon. Evaluation has been subdivided

into sections on examination of neuromuscular function as well as neurologic and psychologic examinations. However, it is stressed that this division is artificial for purpose of discussion and that these cannot be separated in the clinical situation. In the neurologic examination, stress is placed on the patient's ability to organize that which he perceives as well as on sensory and motor deficits. Evaluation of neuromuscular function (activities of daily living) includes intrinsic factors such as motor power, range of motion, muscle tone, coordination, pain, and disuse and also includes extrinsic factors which include noxious stimuli, positioning, and environment. The section on management contains several new and original graphs for illustrating the complex inter-relationship of many factors and considerations in planning management of the brain damaged. This section is brief, well outlined, and includes consideration of the common specific problems of incontinence, decubitus, nutrition, vision and hearing. The last chapter takes up detailed discussions of the management of specific conditions such as the elderly hemiplegic, the child with cerebral palsy, the young adult with multiple sclerosis, the adult with Parkinsonism. Emphasis is placed on planning management of each of these specific conditions on an individual basis from a careful evaluation using the physiological viewpoint. This is a book the physiatrist will not only want to read but own and use often. It is a text in the field of physical medicine and rehabilitation in which he can take pride in presenting to students, interns, residents, and other physicians. (Thomas P. Anderson, M.D.)

**PROGRESS IN THE TREATMENT OF FRACTURES AND DISLOCATIONS 1950-1960.** By Thomas B. Quigley, M.D. and Henry Banks, M.D. Cloth. Price, \$2.50. Pp. 102. W. B. Saunders Company, W. Washington Square, Philadelphia 5, 1960.

These authors are well known. This book is really a monograph reviewing the progress made in the last ten years in the management of fractures and dislocations. Wounds and complications are discussed briefly and the management of all fractures is reviewed briefly. The importance of returning the patient to as near economic self-sufficiency as possible is recognized as of real importance. Open reductions are much more usual. This book is of particular importance in that it has a remarkable bibliography. The authors have reviewed 425 articles, most of these having been written in the past 10 years. A few are used as basis for discussion and for their historical interest. Anyone interested in fractures would not only be interested in the brief reviews but would be particularly interested in this excellent bibliography. (Frances Baker, M.D.)

**THE PATHOLOGY OF CEREBRAL PALSY.** By Abraham Towbin, M.D. Cloth. Price, \$8.00. Pp. 206. Charles C Thomas, Publisher, 301-307 E. Lawrence Ave., Springfield, Ill., 1961.

Dr. Towbin is a pathologist with special experience in neuropathology in Germany and in the United States. His manual on "The Pathology of Cerebral Palsy" is concerned with the need to delineate fundamental organic processes in the brain in this disorder. The importance of the science of pathology in studying cerebral palsy is well presented. The disease is defined and clinical classifications are presented. Neonatal anoxia and other systemic disturbances of the fetus and newborn producing cerebral palsy are presented in an intelligent and orderly fashion. The common triad of mental deficiency, epilepsy and cerebral palsy is the subject of a special chapter. Developmental defects of the brain receive appropriate attention.

The book is printed on excellent paper and is well illustrated with a good bibliography. It is written in a concise manner and handles clinical considerations in such a manner that it will satisfy all physicians who are concerned with basic research or any type of practice related to patients with cerebral palsy. (Charles D. Shields, M.D.)

**SPEECH THERAPY IN CEREBRAL PALSY.** By Merlin J. Mecham, Ph.D., et al. Cloth. Price, \$10.00. Pp. 307. Charles C Thomas, Publisher, 301-307 E. Lawrence Ave., Springfield, Ill., 1960.

Dr. Mecham is Associate Professor, Brigham Young University, Provo, Utah. Mr. Martin J. Berko is a Psychologist in the Institute of Logopedics, Wichita, Kansas and Mr. Francis G. Berko is Teacher in Special Education at the Institute of Logopedics in Wichita, Kansas. The intent of the book is to serve as an orientation to teachers of the orthopedically handicapped, speech therapists, psychologists, physical therapists, occupational therapists, nurses, and many other specialists in the medical and paramedical field who have occasion to work with those who have cerebral palsy. The authors have attempted to condense an enormous amount of information into a common frame of reference for practical use in therapy and education. The authors have reviewed the nature and scope of the problem of cerebral palsy from the standpoint of incidence, etiology, classification, and developmental problems. A chapter is given to the psychological evaluation as an adjunctive tool in communication analysis and training of children with cerebral palsy. Speech defects are described well from the general standpoint of spasticity and ataxia, recognizing that the problems in any one type of cerebral palsy are so diverse that it is practically impossible to draw a

single or composite picture of cerebral palsied children. The problems of hearing impairment, lack of proper stimulation, intellectual impairment, etc., are very well covered. The underlying brain damage in cerebral palsy plus the psychosocial problems which result give rise to many specific speech and hearing problems, including neuromuscular involvements of the speech mechanism; reduced articulatory ability and intelligibility; voice and breathing irregularities; disorders of rhythm, rate, and symbolic functions; and problems in listening discrimination, hearing acuity, and auditory linguistic functions. The need for a continual interchange of information between the medical personnel caring for the cerebral palsied child and the speech therapist is emphasized. Techniques are described on which one may base the therapy for speech and hearing. Therapeutic procedures should be considered in the light of the problems of the particular child, but they can be categorized into the natural divisions of psychological training, physiological training, and direct speech and hearing training. Group therapy is considered to be the core of therapy since oral communication is mainly a social and interpersonal activity. The latter chapters have to do with communication by speech, by reading, and by writing. This book is well-planned, concise, and practical. It should be of value as a textbook for the speech therapist and as a reference for anyone who is managing the cerebral palsied child. (*Frances Baker, M.D.*)

**THE CHOICE OF A MEDICAL CAREER.** Essays on the Fields of Medicine. By *Joseph Garland, M.D.* and *Joseph Stokes III, M.D.* Cloth. Price, \$5.00. Pp. 231. J. B. Lippincott Company, E. Washington Square, Philadelphia 5, 1961.

This collection of 21 essays by 22 contributing physicians is a delight to read. The authors are all outstanding men in their respective specialties. Many are well-known teachers and writers. The essays are designed primarily for the orientation of medical students in the later years of their training or during internship when thoughts of specialization and type of medical practice or work are uppermost in their minds. Essays on all of the recognized medical and surgical specialties are presented. For the most part, subspecialties are not represented by individual essays. The majority of the essays are written in an informal manner and give a bit of the history of the specialty, its scope, requirements for training, and some of the attitudes and thoughts that the experienced specialists have relative to their particular branches of medicine or surgery. Although some of the articles

present a picture that may seem somewhat idealized, in general it seems that a fair evaluation is given of opportunities and experiences to be expected during training and practice in each field. Dr. Howard Rusk has contributed an excellent discussion of the specialty of physical medicine and rehabilitation. General practice has not been neglected, nor have the opportunities in the fields of the basic medical sciences. The introductory essay by C. Sidney Burwell on "The Art and the Science" and the final essay by William B. Bean on "Caritas Medici" serve to round out the book and emphasize the art and the human touch that must be foremost in the minds of all practitioners at all times in dealing with their patients as individuals. Although this book is particularly recommended for advanced medical students, it provides interesting, informative and thought-provoking reading for any physician, helping him to understand better the specialists in fields other than his own. (*Gordon M. Martin, M.D.*)

**THE TUTORING OF BRAIN-INJURED MENTALLY RETARDED CHILDREN.** By *James J. Gallagher, Ph.D.* Cloth. Price, \$6.75. Pp. 194. Charles C Thomas, Publisher, 301-307 E. Lawrence Ave., Springfield, Ill., 1960.

Dr. Gallagher is at the Institute for Research on Exceptional Children, University of Illinois, Urbana, Illinois. Samuel A. Kirk, Ph.D., is Director of the Institute and writes a foreword which is excellent for this experimental study. Since a great deal of work has been done with regard to the retarded child from the standpoint of the neurologist, psychologist, physiologist, etc., it seemed well to make a study of what careful tutoring might do for the retarded child. Binet did not feel that the I.Q. was constant or that mental deficiency was a static condition. Professor Gallagher by his experiment has demonstrated that educational methods can be subjected to rigid research controls. Some children make progress under tutoring while others do not. The best results were obtained on children of the younger age group rather than the older age group. Individual tutoring was thought to be the most adequate answer to the educational problems presented by brain injured children. Attention could be better controlled. The tutor was able to try a variety of methods and approaches in order to stimulate an adequate motivational response on the part of the child. This study was made at the Dixon State School for the Mentally Retarded at Dixon, Illinois. Forty-two brain injured, mentally retarded children were chosen. Ages were seven to 13 years and their Stanford-Binet I.Q. scores ranged from 32 to 63. Of the children who made substantial gains there was a distinct tendency for the improvement to be



concentrated in a one-year period. The introductory chapter discusses the operation of the brain as it is recognized today and reasons for the improvement in the younger child. The methods of tutoring are discussed, and the results. I think that we can recognize this book as being quite profound but easily read, and it should be of value to anyone who is interested in the retarded child since its approach is hopeful rather than negative.  
(Frances Baker, M.D.)

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*Of the many things man can do  
or make here below, by far the  
most momentous, wonderful  
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